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ORIGINAL ARTICLES

SUGGESTIONS IN X-RAY TECHNIC FOR THE ORTHODONTIST.

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IT is no longer necessary to advocate the use of the x-ray in any of the various branches of dentistry, as its merits and possibilities are well known. The number of instances in practice where the x-ray proves a valuable adjunct in diagnosis and in checking up the progress of treatment, is on the increase, as children are receiving orthodontic advantages at an earlier age than was customary a few years ago. In most of these cases many of the deciduous teeth are still present, so that intelligent treatment demands radiographic evidence as to their successors, their state of development, etc.

The popular conception of the x-ray laboratory is that it is a "place apart," filled with expensive apparatus in which strange and mysterious things transpire; where the operator presides like some ancient alchemist and directs the mysterious forces which bring about startling results.

As a matter of fact there is nothing about it to justify such a conception. In the first place, it need not be a place apart, but simply an addition to the ordinary operating room of apparatus which is no more expensive than the other requisites of practice such as cabinets, chairs, cuspidors, engines, etc.

The knowledge required for the successful operation of x-ray apparatus, is no more difficult to acquire than is any other knowledge which is worth while, and like such knowledge, it has its reward. In fact, there are few fields of collateral science which offer greater opportunity for help to the dental profession than that awaiting them in the branch of physics of which the x-ray is a part.

The requisities of an x-ray laboratory for the orthodontist are not numerous, but consist of

1st—A so-called x-ray machine (an induction coil or transformer).

2nd—An x-ray tube.

3rd—An adjustable tube stand for holding the tube, which should include a tube shield made preferably of leaded glass, serving as a means of

confining the rays and as a means of protecting the operator, and a lead compression diaphragm and lead lined compression cylinder.

4th—A photographic dark room.

THE ARRANGEMENT OF THE APPARATUS IN THE OFFICE.

If such an equipment is contemplated, the question naturally arises, where can the necessary apparatus be placed? While a separate room is desirable, it is by no means necessary, as the ordinary operating room of fair size can be made to accommodate it.

The coil or transformer and tube stand can be placed against the wall

Fig. 1.—A convenient manner of arranging the necessary apparatus when not in use.

at the left side of the room, while the tubes can be hung in a suitable rack upon the wall where they will be out of harm's way. Arranged in this manner, x-ray apparatus is not in the way and is accessible for use at any time. (Fig. 1).

The dental chair with its multitude of adjustments serves an important purpose in the dental x-ray laboratory, for the patient must be able to hold perfectly quiet during the time the exposure is made. Owing to the stability of the chair and its many adjustments, this is not only possible but preferable to having the patient lie upon a table, which has been the method employed by many radiographers, in the past.

THE PHOTOGRAPHIC DARK ROOM.

One of the most important requisites of the dental x-ray laboratory, is the photographic dark room, and any one attempting to do radiography without it is greatly handicapped. It need not be large or elaborate, and running water is not absolutely essential, although it is an advantage. A closet 3½x5 feet will suffice if nothing better is available. A broad shelf should be placed at one end to hold the developing trays and other photographic accessories.

With a dark room always available, the dental radiographer is able to develop his plates or films immediately, profit by their findings, or in case they do not come out satisfactorily, make others without subjecting his patient to the inconvenience of another appointment.

Fig. 2.—The patient may hold the film in place by exerting slight pressure with the thumb.

THE TECHNIC OF DENTAL AND ORAL RADIOGRAPHY.

Having named the requisites of the dental x-ray laboratory, let us now proceed to a consideration of their application in the actual work of radiography.

The very nature of the structures with which we concern ourselves, their gross as well as their minute anatomy, renders them somewhat difficult to radiograph, and necessitates refinement of technic greater than that demanded with the other portions of the human anatomy. It would therefore seem obvious that an accurate knowledge and anatomic appreciation of the structures of the oral cavity and associated organs and structures is the first requisite for successful dental and oral radiography.

In order to obtain a radiograph of any portion of the body, it is necessary to have a photographic or x-ray plate (properly prepared so as to exclude all light and moisture), placed in such a position that the rays passing through the structures desired, will register their shadows with the least amount of distortion possible upon the plate.

In securing shadowgraphic representations of the dental and oral structures, two general methods of procedure are open to us, each of which has its value and special indications. These are known as the "Intra-Oral" and "Extra-Oral" methods.

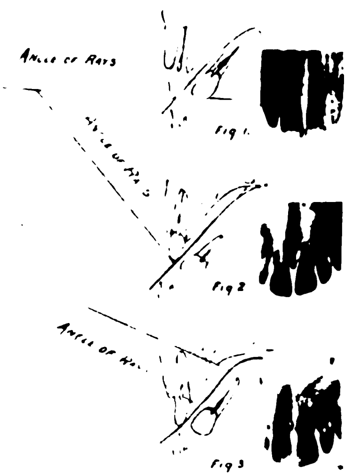


Fig. 3.—Showing the results of correct and incorrect technic.

Fig. 4.—The patient holds the film in place against the lower teeth with the finger.

With the first, only small films are used which are placed within the mouth opposite the area to be radiographed, and held in position either by means of a tray or film holder, or by the assistant, or better still, by the patient exerting slight pressure with the finger. This method is indicated where radiographs of *small areas only* are desired, as, for instance, two or three of the upper teeth, with the adjacent alveolar process. It is used to particular advantage in radiographing the area lying between the upper

cuspids, where a high degree of detail is desired. In fact, it can be used in any part of the mouth where small areas only are desired.

With the other method of procedure mentioned, viz., the "Extra-Oral" method, large plates or films are used and the areas desired are brought in as close contact as possible with the plate by pressing or resting the face against it. The x-rays are then passed through the structures from the other side of the skull, so as to pass through the entire face or skull, in transit.

When using this method, large areas may be radiographed which in some instances will embrace the lateral halves of both the upper and lower jaws from the cuspid region anteriorly to the angle of the jaw posteriorly, and from the floor of the orbit above to the inferior margin of the mandible below. In fact, it is possible by making several exposures to obtain in detail a shadowgraphic representation of the dental apparatus "in toto" as well as its associated organs and structures, the nasal cavity and pneumatic sinuses, the maxilla and the mandible.

Fig. 5.—The head rest of the dental chair with its many possible adjustments can easily be placed so that the patient's head rests easily and firmly upon it.

It should be apparent to any one that the first method greatly reduces the possibilities of the x-ray. Both methods have their advantages and neither should be discarded in favor of the other.

The Intra-Oral Method.

We will first discuss the Intra-Oral method by which small areas are radiographed. First of all, the patient should be placed in a comfortable position, and the head supported so that it may be held perfectly still. After the tube has been tested out and the proper degree of vacuum established, the tube stand (complete with the other apparatus before described) is moved to a position where the rays coming from the tube, through the compression diaphragm and cylinder, can be made to pass through the desired areas and cast their shadows upon the small plate within the mouth. (Fig. 2.)

In using this method upon the upper teeth, the greatest care must be exercised that the shadows produced are free from distortion, for the film must

be held within the upper arch against the lingual side of the teeth and the palate, and must occupy a position which is in a different plane from that occupied by the roots of the teeth. Whenever it is necessary to direct the rays upon structures which lie at an angle with the plate or film, correct shadows may be obtained by adhering to the following rule: "Bisect the angle made by the plane of the teeth, and the plane of the film, and direct the rays so that they will fall perpendicularly to this bisecting plane."* (Fig. 3.)

Failure to adhere strictly to this rule is one of the most common causes of partial or complete failure in producing true shadowgraphic representa-

Fig. 6.—It requires but a few movements to arrange the apparatus in this manner. The comfortable position of the patient makes it an easy matter to remain perfectly quiet.

tions of the dental structures. For instance, if the rays are directed from too low a source, the shadows will be lengthened, or if they be directed from too high a source, the shadows will be foreshortened, the amount of elongation or foreshortening being in direct proportion to the amount of deviation from the proper focal point.

In using this method upon the lower teeth, we do not have this difficulty to contend with, as the films can be placed for the most part in such a position that they lie parallel to the long axis of the teeth, and the rays can be directed in a perpendicular direction both to the plane of the teeth and the plane of the film. (Fig. 4.)

*Technic of Dr. Weston Price.

Another point of technic which should not be overlooked if sharp outlines are to be obtained, is the one in regard to having the tube placed at the proper distance from the structures to be radiographed. To establish the best focal distance for work about the teeth or jaws, the target of the tube should be about twenty inches from the plate.

With a good induction coil or transformer, and a properly regulated tube, good radiographs can be obtained by very short exposures, particularly by using the Intra-Oral method, as the rays need only penetrate a comparatively short distance before reaching the plate. With the apparatus now available good radiographs can be obtained by instantaneous exposures.

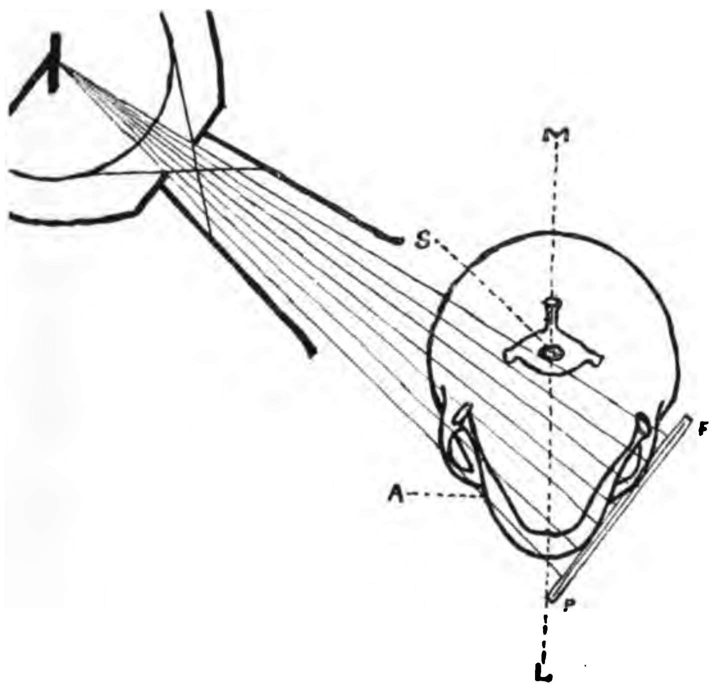


Fig. 7.—This shows a cross-section of the skull in the region of the teeth, and illustrates the manner in which the rays must be directed to get a radiograph of the left side which will include the upper and lower teeth from the cuspid region to the angle of the jaw.

THE EXTRA-ORAL METHOD.

The Extra-Oral method is in my opinion the one offering the widest range of usefulness in our work. As stated previously, this is the method used to obtain radiographs of large areas. Not only can larger areas be obtained by this method, but locations and structures inaccessible to the small films are reached and their images accurately and clearly recorded upon the larger plates. Therefore, the advantage of this method is well founded.

The technic is simple when once mastered, but must be adhered to accurately if the results are to be depended upon for diagnosis. In using the Extra-Oral method, large plates or films are used and the areas desired are brought in as close a contact as possible with the plate by pressing or resting the side or portion of the face upon which the structures desired are located, against the plate. (Fig. 5.)

First of all, the patient must be placed in a position so that the head can be held perfectly still. The dental chair with a few adjustments, offers an excellent means for accomplishing this. One of the chair arms is lowered down against the side of the chair or removed, and the patient placed sideways in the chair. The chair back is adjusted so that the patient lies against it in an easy position, and the head rest wings are adjusted so as to lie flat and thereby form an excellent resting place for the plate. The head rest with its many possible adjustments can easily be placed so that the patient's

Fig. 8.—A radiograph made using the technic as shown in Figs. 6 and 7.

head rests easily and firmly upon the plate, rendering it an easy matter to remain perfectly quiet.

The Author's Method of Seating the Patient.

In the author's opinion, there is another method of seating the patient for this character of work which necessitates less confusion in the office than the method just described. It is accomplished by using an ordinary chair with a straight back and small arms, placed against the back of the dental chair. The head rest of the chair (Fig. 6) is turned over and adjusted to the proper height, position and angle, so that the patient's head can rest against

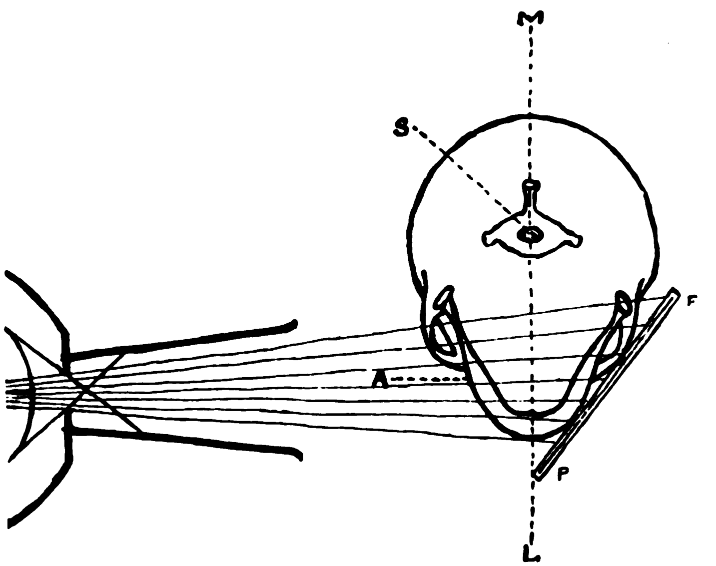


Fig. 9.—Incorrect technic. The shadows of both sides will be imposed upon the plate

Fig. 10.—The result of poor technic. This is a radiograph of the same subject as shown in Fig. 8.

it in any desired position. In this way the patient is afforded the firm support of the heavy dental chair, and therefore has little difficulty in remaining perfectly quiet, and the operator can, by making a few changes in the position of the small chair, by moving and readjusting the tube stand and the head rest, have access to any part of the dental apparatus.

The fact that this requires but a few moments, does not disarrange the office or put the patient to discomfort, justifies the author in feeling that it is by all means the preferable method for use in the dental office.

With the head thus supported, the rays are directed from the opposite side of the head, and therefore must pass through the entire face or skull in transit. The question naturally arises, how is this to be accomplished

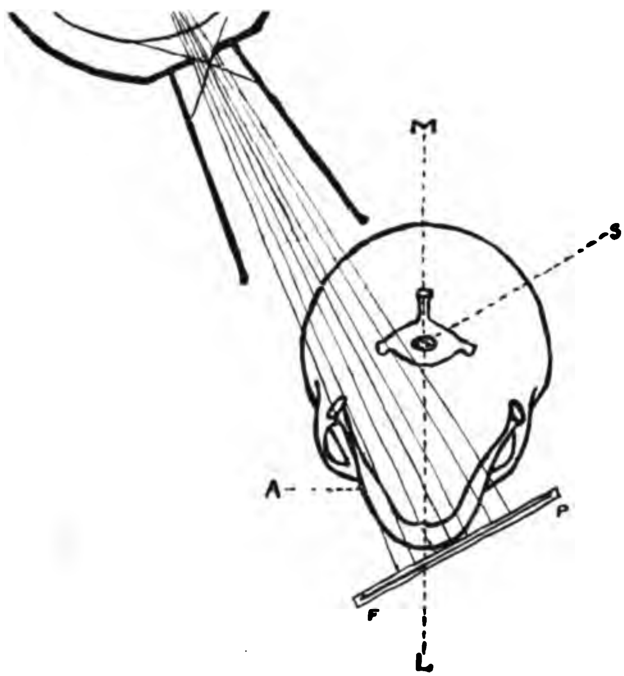


Fig. 11.

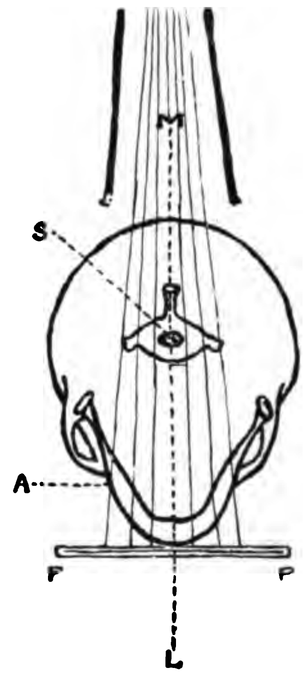


Fig. 12.

Fig. 11.—The areas in the upper and lower jaws extending from the median line to the first premolar can be radiographed by utilizing this technic.

Fig. 12.—The structures at the median line including the incisors, both above and below, may be secured in this way.

without superimposing the shadows of one side upon the shadows of the other side, and thereby producing a chaotic result.

For instance, let us suppose that we wish to obtain a radiograph of the left side of the upper and lower jaws extending from the cuspid region in front to the angle of the jaw behind, and from the floor of the orbit above to the inferior margin of the mandible below. If we are to get a correct shadowgraphic representation of this area, it should be free from the shadows of the opposite side, and this can only be accomplished by directing the rays in such a manner that they will miss the area not desired and will pass through those we wish to record.

In accomplishing this, we must take into consideration two structures,

viz., the spine and the angle of the jaw (on the left side in the instance) and cause the rays to pass in through this opening and thereby reach the desired area. (Fig. 7.)

An important factor in accomplishing this is the position in which the patient's head is held as it is pressed against the plate. Held in the manner shown in Fig. 6, the rays can be directed in between the angle of the jaw and the spine, and can pass in a perpendicular direction to the long axis of the teeth and the plate, giving correct shadow lengths upon the plate. Fig. 8 shows a radiograph made by using this technic.

If this rule be disregarded and the rays passed through the structures,

Fig. 13.—In following the technic, illustrated in Fig. 12, the patient's head should be supported by a bandage of gauze to insure perfect immobility.

as shown in Fig. 9, the shadows of the opposite side will be superimposed upon the structures desired and a chaotic result produced. The result of such technic is shown in Fig. 10.

When ready to make the exposure for such a picture, the apparatus is arranged with the anode of the tube about twenty inches from the plate.

In a similar manner as shown in Fig. 7, with slight adjustments in the position of the plate, the head and the tube, the areas in the upper and lower jaws extending from the median line to the first premolars, and from the nose above to the inferior margin of the mandible below, can be radiographed, (Fig. 11). Likewise the structures at the median line including the incisors, both above and below, the anterior portions of the mandible and maxilla.

Fig. 14.

Fig. 15.

Figs. 14 and 15.—These radiographs are an instance of the utility of the x-ray in determining the state of dentition of a young patient where deciduous teeth are still present. The technic used is illustrated in Figs. 6 and 7.

the nasal cavity and its accessory sinuses, may be radiographed by passing the rays directly through the skull. In this instance, the shadow of the spine will be superimposed upon the dental structures, but owing to the fact that it is so far removed from the plate, its shadows does not interfere seriously. It is also important, in making these pictures, to have the patient's head supported in such a manner that it can be held still for a longer period than is required in making the exposures of the other areas mentioned.

I do not wish to imply by the preceding remarks upon technic that the few rules enumerated constitute a safe and never failing means of producing good radiographs. There are many points to be considered which cannot be included in so limited a discussion, such as the mechanics of tube regulation, coil operation, exposure and development of plates, and last but not least, the variations from the given rules of technic made necessary by the anatomic variations in the dental and oral structures of patients. Therefore the rules of technic which have been presented must be accepted only in the light of principles.

AN EFFECTIVE METHOD FOR THE MESIAL OR DISTAL MOVEMENT OF INDIVIDUAL TEETH IN THE ARCH.

By Harry E. Kelsey, D.D.S.

Lecturer on Orthodontia, Baltimore College of Dental Surgery, Baltimore, Md.

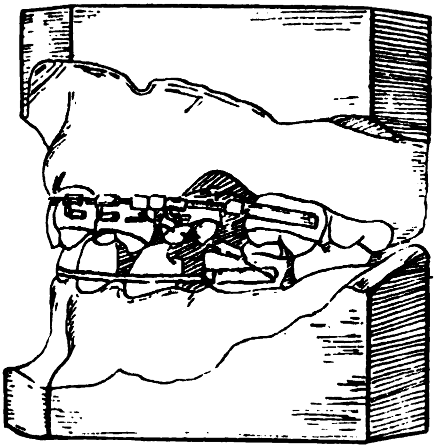
It is not likely that the application of force as described in the following paragraph is original, although the writer has not seen it described elsewhere. It has, however, proven most useful and effective in his hands, and is a possible addition to the technic of such operations. The writer finds it chiefly useful in opening up spaces in the arch that have been lost after the extraction of teeth, or in cases where certain teeth are congenitally absent, notably the lateral incisors.

The method consists in applying an arch which has been threaded throughout its entire length and upon which tubes with attached hooks have been placed, so that they may run freely upon the arch. Bands are then placed upon the teeth adjacent to the lost space—in case of a missing lateral they would be upon the cuspid and central incisor—these bands having horizontal tubes soldered to them parallel to the arch and large enough to receive a 30/1000 wire of which the hook is made. The writer prefers to use square wire for the arch, as it is less liable to break when bending after being threaded, and small nuts which are used behind the sheath hooks may always be kept snug and tight on the arch by a slight compression, thus preventing any tendency to loosen, as is the case when a round arch is used.

Reciprocal anchorage can often be entirely depended on for opening up a space, that is, the teeth on either side of the space may be operated against each other, but as much additional simple anchorage may be added thereto upon either side of the space as there are teeth to include in it, and this

simple anchorage may be made stationary or not as desired, according to the manner of its attachment to the arch. If it is desired to tip a tooth instead of moving it bodily, and at the same time prevent rotation, a small U-shaped crotch may be attached either mesially or distally upon the band, and the arm from the sliding tube may be made to extend lingually to engage in the crotch, after which the ends may be bent over to secure it, or it may be secured with a ligature.

When rotation of a tooth to be moved mesially or distally is desired, it may be accomplished, if not too extensive, by applying the tube and sheath hook in such a manner as to produce the desired result, that is, the arm of the hook will be bent so that it is not exactly parallel to the tube but may be forced into it through the elasticity of the arch. If, however, considerable rotation is required, it is better to place a lug on the band as for any rotating ligature, and carry it around either the mesial or distal surface of the



Showing author's method for the mesial or distal movement of individual teeth in the arch.

tooth according to which way it is to be rotated, twisting it around the movable sheath hook instead of upon the arch itself. As the sheath hook is then moved by the nut back of it, the tooth will not only move mesially or distally as the case may be, but will rotate at the same time.

A hook for the intermaxillary elastic may be devised by soldering same to a small nut which may be screwed upon the arch to any convenient position and move forward or backward as the requirements of the other apparatus demand. Of course the anchorage necessary to move distally a tooth in one arch must be extensive, and it is usually necessary to supplement the anchorage in the one arch by an intermaxillary anchorage to the other.

The illustration shows a case in which both permanent laterals are missing and a second temporary molar had been impacted between the sixth year molar and second bicuspid until maturity. All of the anterior teeth from the left second bicuspid to the right central must be moved distally toward the left sixth year molar.

TREATMENT BY THE ORTHODONTIST SUPPLEMENTING THAT BY THE RHINOLOGIST.*

By A. H. Ketcham, D.D.S., Denver, Colo.

IN the paper just read, Dr. Noyes has shown how the dental arches, bones of the face and the nasal cavity develop normally in response to perfectly balanced forces. He has also shown how they develop abnormally in response to interference with normal forces. It is my purpose to show how the orthodontist may overcome abnormal forces; how he may interrupt the progress of the abnormal formation of the bones and tissues of the jaws, the face and the nasal cavity, as well as the accessory sinuses; how normal forces may then be made to act so that abnormal development may give way to normal development, and the poorly developed mouth-breather, who usually is backward mentally as well as physically, may be induced to develop along physiological lines.

I understand that many of your patients are mouth-breathers, breathing through the mouth at least part of the time; that the principal cause of mouth-breathing is the presence of adenoid vegetations; that you often have associated with these, enlargement of the tonsils and also a deflected septum. The other causes of nasal stenosis—such as a deflected septum due to trauma, hypertrophy, ledges and spurs, and also hypertrophy of the turbinates, do not occur as frequently. I find by experience that many of your patients over 7 or 8 years of age, upon whom you have operated for adenoids, have not been cured of mouth-breathing. Dr. Noyes has shown the reason for this, for if an abnormal force such as breathing through the mouth has been operating for a considerable length of time, lack of development of the involved bones and muscles, malocclusion of the teeth, with hypertrophy of the lining membrane of the nose, due to altered atmospheric pressure, must result.

In order to make certain that my experience was not exceptional, I sent a list of questions to eighty-five orthodontists of full experience, most of whom replied, and their answers show that the majority of the orthodontist's patients are mouth-breathers when first examined,—though most have undergone an operation for removal of adenoids. The minority, though afflicted with malocclusion of the teeth and more or less constricted dental arches, have sufficient breathing-space and have never suffered from enlarged adenoids or other form of nasal obstruction. I do not know what percentage of your adenoid cases have broad dental arches with well-developed nasal spaces, but I take it for granted that it is very small; for, in these cases, the presence of adenoids—unless in large masses—would not interfere with the patient's breathing. The evidence which is forced upon the orthodontist is that while the adenoid operation is quite necessary, it alone is not often a cure for mouth-breathing, except in the younger patients where the cause had been operative for but a short time and has not caused malformation of the bones or abnormal development of the muscles involved, although at the early age of 4, and 4½ years, great malformation may result as is shown in Fig. 1.

*Read at the meeting of the American Laryngological, Rhinological and Otological Society, Philadelphia, May 14, 1912. With appendix and several illustrations added to show the improvement in occlusion of the teeth up to date.

You may ask: When the rhinologist has failed to establish normal breathing, how can the orthodontist relieve this condition? In the first place, I will take for illustration an aggravated case (Figs. 2 and 3), from that type in which there is ample breathing-space after adenoids have been removed, yet the child continues to breath through the mouth. It is impossible to close the lips on account of the protrusion of the upper anterior

Fig. 1.

Fig. 2.

teeth. You can readily see that by reducing these abnormal relations that the orthodontist can make it possible for the patient to close the lips and breathe through the nose (Figs. 4 and 5). This also established a normal distribution of the forces of occlusion in the mastication of food; of tongue-pressure inside the dental arches and of lip and cheek-pressure outside, and the establishment of normal air-pressure in the nasal cavity. By use, the weak upper lip is developed. By eliminating abnormal exercise—in making it impossible for the lower lip to be drawn in behind the upper incisors—its thickness is reduced. The muscles which hold the mandible forward are strengthened, and the mouth is kept closed by the wearing of intermaxillary elastics from the region of the upper canine to the lower first molar. These

ligatures are usually worn day and night during the active period of treatment and at night during the period of retention, which should last until mouth-breathing has been overcome.

Now comes the question of those cases in which the nasal space is lacking

Fig. 3.

Fig. 5.

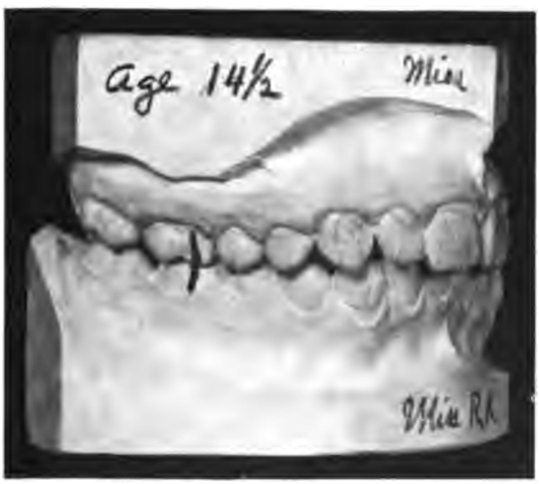


Fig. 4.

in development, in which the dental arches and maxillary bones are narrow, in which the removal of adenoids has been of no appreciable benefit to the breathing. What can the orthodontist do to help these cases? In the younger patients he can establish a balance of the forces of occlusion and thus

stimulate growth and overcome the arrested development by applying gentle pressure to the teeth, gradually widening the dental arches and placing the upper and lower teeth in their normal relations, so that the force in masticating food is transmitted through the teeth to the maxillary bones and their

Fig. 6.

Fig. 7.

palatine processes which form the floor of the nose. These forces which are now correctly distributed will continue the development and widening of the nasal cavity. When the septum is deflected it will usually be benefited. Of course, we cannot hope by this means to overcome deflection due to trauma,

hypertrophy, ledges and spurs. You may think that I am oversanguine, but the evidence furnished by orthodontists is overwhelmingly in the affirmative. A large number of cases have been cited where children with constricted nasal

Fig. 8.

Fig. 9.

spaces have developed efficient breathing-spaces as a result of stimulation through the work of the orthodontist. The majority of these patients had improved in general health and gained in weight to a greater extent than ever

before during a similar period, and had gained more than the average child at a corresponding age; gains of from fifteen to twenty-five pounds during the first year's treatment are not at all infrequent. In many of these cases adenoids had been removed several years prior to the beginning of orthodontic treatment, the patient remaining a mouth-breather without experiencing any particular improvement in general health or the normal gain in growth and development.

This type of cases is well illustrated by Figs. 6 and 7. History is as follows: Enlarged tonsils removed at 6 years of age; adenoids one year later, but the operations were too late to materially help the nasal space or the dental arches, for growth had been so much arrested that while removal of tonsils and adenoids prevented the case from becoming even worse, yet you see what a badly-constricted arch and what maloccluded teeth the patient had at fourteen years of age, when he presented for orthodontic treatment. The boy's rhinologist, Dr. T. E. Carmody, of Denver, reported that on examination he found the nasal space to be about one-half normal not only on account of narrowing, but on account of an intumescent condition of the tissues; septum deflected to the right. It was examined at intervals of several weeks and after packing with adrenalin, the intumescence would disappear and show a narrow nasal space, which became greater as treatment progressed (Fig. 7). The condition on the oral side of the palatine portion of the maxillary bones was fully as bad. The distance across the roof of the mouth between the upper second premolars at the gum-line was but eighteen millimeters.

Extraction of two or more premolars and the drawing back and down of the upper canines, would have been our only recourse a few years previous to the time this case was treated. Unfortunately such procedure is sometimes followed to-day, but it leaves the maxillary arch just as narrow as before treatment, and thus can have no beneficial effect upon the nasal cavity. It leaves the teeth still in malocclusion with no improvement in function. The patient is left with an undeveloped nasal cavity, deformed oral cavity, with little chance of reaching normal physical development. Fortunately, Dr. Edward H. Angle, a few years ago, proved that in these cases, by retaining the full complement of teeth and placing them in their normal positions, development of the alveolar process over the roots of the teeth would take place and there would be a building-in of bone. This was proved in a number of instances by carefully made models.

Since this development of the alveolar process takes place, it is logical to assume there must be a similar development of the maxillary bones, and consequent increase in size of the nasal cavity. This has been verified in many cases by rhinologists' examinations before and after the orthodontist's treatment.

By a new appliance designed by Dr. Angle, we are now able to move the roots of the teeth out as rapidly as we do the crowns; thus transmitting the gentle stimulation directly to the body of the maxillary bones.

To continue the history of this case (Figs. 8 and 9): The dental arches were widened and the crowns of the teeth placed in their correct positions. The active tooth-movement was completed in less than a year's time. The boy, who was poorly nourished and stunted when treatment was begun,

did not suffer, but gained in weight and health during the operation. At the end of this period he again visited his rhinologist who reported that the nasal space was about two-thirds to three-fourths normal, due to apparent widening of the nasal space and subsidence of the intumescence. This as a result of widening the maxillary arch. The measurements showed a gain of thirteen millimeters across the arch. Three and one-half years after active treatment was completed, his rhinologist reported: Nasal space apparently normal: septum straight; turbinates normal (Fig. 10).

Some have claimed that by widening the dental arch the roof of the mouth is lowered. Others claim that this is not true. In my opinion, both statements are partly correct and partly incorrect. It is plain, by dropping a

Fig. 10.

perpendicular line from the roof of the mouth to the plane of the occlusal surfaces of the teeth in Fig. 10, that the roof is higher in the finished case than in the one before treatment. Could we also measure from the apex of the nasal cavity to its floor, we should find that the distance had increased there also; in other words, there has been a general development of the bones of the face in that they have grown downward and forward as well as broader.

After 16 years of age, establishing normal balance of all the oral forces helps the nasal cavity, though not to as great an extent as in the younger child, but it is certainly worth while.

I have been asked to express an opinion as to what benefit the nasal

cavity derives from the attempted opening of the median maxillary suture, as advocated by a number of operators, principal among these being Dr. G. V. I. Brown, of Milwaukee, who was one of the first[1] to advocate this for the purpose of widening the nasal cavity and allowing the vomer to slip down into the open suture, with the expectation that the deflected septum would straighten, though this operation was mentioned in the *Dental Cosmos* in 1860.

At the outset, I wish to say that all my experience in this operation is of a negative character, in that, while I have tried to separate the median maxillary suture—both in the living subject and in a cadaver,—I have failed, or, at any rate, have not been able to prove that I opened this suture. The latter experiment was on the cadaver of a 4 or 5-year-old child in which I dissected away the tissues down to the sutures from over the palatal bones forward along the median maxillary suture up to the sutures of the nasal bones, and then carefully constructed an appliance after Dr. Brown's methods, which I anchored to the firm temporary canines and to the second temporary molars (the one upon the right side being slightly weakened as result of an abscess). I applied pressure with the jack-screw and widened the arch five millimeters, at which point the buccal alveolar plate of bone upon the right side gave way. There was no increase in distance across the opening of the nasal cavity—which I measured and marked carefully before pressure was applied to the teeth—nor had the median maxillary suture opened in the least. I cannot say whether or not it would have opened had the alveolar process around the right second temporary molar been as strong as the one on the opposite side.

In the *Dental Cosmos* for January, 1909, Dr. Brown, in speaking of opening the median maxillary suture, says; "By the aid of pressure, which is so gently applied that there is no pain and but little inconvenience for the patient, it is possible in all young persons to force the maxillaries apart by separating the median suture extending between the central incisor teeth and on through the central portion of the hard palate. This method is also practicable in older persons, as is shown in our illustrations. Evidence of this is given by the fact that the central incisors are moved apart without an attachment or a direct pressure of any kind being applied to these teeth."

Some operators, including myself, have attempted to show by the means of radiographs that the median maxillary suture has been opened. Our radiographs have failed to prove that the suture has been opened except between the pre-maxillaries.

In answer to Dr. Brown's argument that the suture has been opened because the central incisors were moved apart, I would say, it is often the experience of an orthodontist when widening the upper dental arch,—especially by means of the appliance known as the expansion arch,—that if he ligates the canines to the wire arch without ligating the incisors, a space will soon develop between the central incisors. I can explain it from a fact which I discovered a number of years ago while studying the suture between the pre-maxillaries by means of the radiograph,[2] that this suture was open in

1.—Report in the Journal A. M. A., March 27, 1909.

2.—The results were given in a paper read before the Alumni Society of the Angle School of Orthodontia, at St. Louis, December, 1906, and published in the American Orthodontist, Vol. 1, No. 1.

depths of from one-third to the full length of the central incisor's root in two-thirds of the cases examined.

Dr. George Wright, of Boston, in June, 1911, *Cosmos*, reports: "Up to the spring of 1910 I could safely say that in some instances I have known the inter-maxillary and palatine suture to be unossified and susceptible of comparatively easy separation as late as 35 years. When I discussed this question with Professor Hirdlicka of the National Museum at Washington, where I examined many skulls, he agreed with me, and showed me some skulls of Eskimos whom he had known when living and of whose age he was sure. These are as old as 50 years and showed the distinct evidence of inter-membranous tissue in the inter-maxillary suture and no evidence of ossification. A skull in his collection illustrating this, is numbered 226,152. There are many others."

My studies with the radiographs confirm Dr. Wright's observation in as far as the open suture applies to the pre-maxillaries.

I wish to caution against accepting evidence furnished by radiographs

Fig. 11.

unless very carefully and skillfully made, and then interpreted as skillfully. A thick nasal spine or vomer may give the impression that the suture has been opened, as illustrated by a case where the dense walls of the nasal spine were caught on edge so as to stop the rays, while the light penetrated the thinner cancellated bone between these plates easily, giving the appearance of an open suture in this region.

While I have been unable to secure proof that the median maxillary suture has ever been opened by rapid widening of the dental arch, yet I believe that it may be possible to do this in the case of young children, but, it is in these cases that we can secure most beautiful results by gradual tooth-movement, thus stimulating bone-development, which is not alone along the lines of the sutures, but in the body of the bones as well, and in this we are working along physiological lines,—aiding Nature to attain the normal, and not abruptly attempting to open the suture and practically producing a fracture by widening the arch in two weeks' time, as Dr. Brown recommends. Neither is the actual time of treatment shortened, for all the

teeth must be placed in their normal positions whether the arch be widened rapidly or slowly. Then they must be retained for a year or two. The shorter the active period of treatment the longer the peroid or retention, for the teeth must be supported until Nature builds permanent bone-retainers. Dr. Albin Oppenheim, of Vienna, after extensive investigation, has shown that by the application of powerful forces as in the rapid widening of the maxillary arch, the vitality of the periosteum is so lowered that a long period of time is required to regain the normal physiological condition so it may transform the new bone to retain the teeth.[3]

Dr. George Wright has designed an instrument for measuring the nasal space, as also Dr. Lee W. Dean of Iowa City, and although there is chance for error in the use of these instruments they confirm the rhinologist's observations of increased nasal space, especially in the case of Dr. Wright's instrument when he measures between the naso-antral walls at a point beneath the inferior turbinates.

Fig 12.

In regard to patients 16 years of age or older, we have reliable data that the nasal space has been increased in size from the rapid widening of the dental arch, yet we also have reliable reports from rhinologists that the breathing-space has been improved in these older cases where the more gradual widening of the dental arch was practiced. I believe that in both cases the improvement in breathing was due to development as a result of the stimulation upon the maxillary bones of placing the oral cavity under the influence of normal forces so that it could functionate properly.

I think that all the gentlemen who advise the rapid widening of the maxillary dental arch, also advise widening of the lower arch, if that is constricted as well, so that the upper and lower teeth may occlude properly. That this has not always been practiced is evident from this case (Fig. 11), in which the upper buccal teeth were pushed out until they occluded outside the lowers, and until the central incisors were separated.

3. The American Orthodontist, January, 1912, page 129.

History of case reported by Dr. M. N. Federspiel, of Milwaukee: "A lady, about 19 years of age, reported to my office about a year ago. She consulted a rhinologist about five years ago on account of suffering from an acute suppurative inflammatory condition of her nose. Her rhinologist informed her that she had a deflected septum and suggested to her that it could be straightened by radically expanding the upper arch. She was directed to a specialist and an appliance was placed in her mouth with jack-screws, and the upper arch widened in about two months, causing her centrals to separate. Nothing was done to the lower arch. She wore a retainer for a year and was discharged cured. Upon examination I found that the septum was still deflected, but the nose otherwise normal. I asked her if it was easier for her to breathe since the arch was expanded, and she said that

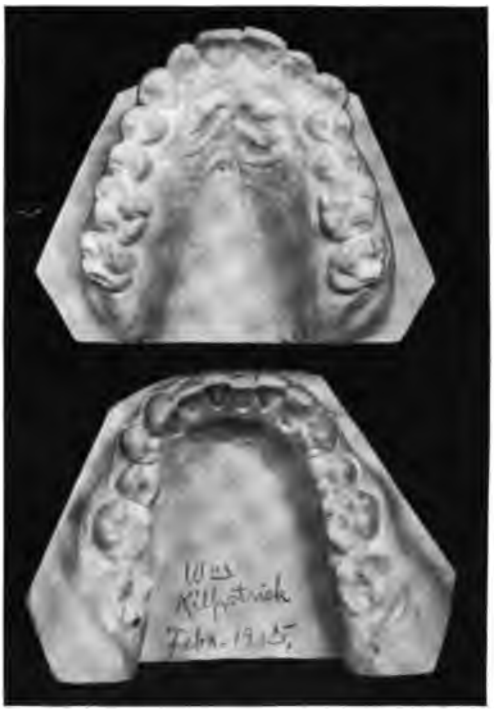


Fig. 13.

she could not notice any difference." A result like the one shown in Figure 11, leaves the oral cavity in a condition which is a greater menace to health than the nasal condition could have been.

I believe we cannot hope for any permanent benefit from this operation unless the teeth are left in their normal relations, so as to be under the influence of normal forces and stimulate normal function.

As near as I have been able to determine, absorption of adenoid tissue is not hastened by the widening of the maxillary dental arch and the consequent increase in the size of the nasal cavity.

In my own experience adenoid tissue has increased in size in at least two cases while the patients were under my care; in other words, colds and

infection more than counter-balanced any beneficial effect that expansion of the dental arch migh have had upon the adenoid tissue. A number of instances have been cited where adenoid tissue has atrophied, or partially so, during the widening of the maxillary arch, but it was at the time of puberty so was probably not due to the intervention of the orthodontist. Also direct benefit to the tonsils from orthodontic work does not seem to result unless there would be less likelihood of infection of the tonsils, by the orthodontist changing a mouth-breather to a normal breather.

To be of the greatest benefit to humanity, the rhinologist and orthodontist must work together, for the work of one often supplements that of the other. The orthodontist cannot hope for permanent success in a case where mouth-breathing has caused malocclusion of the teeth, unless the rhinologist removes the primary cause of the mouth-breathing. Our most careful operators explain this when starting a case and insist on the removal of adenoids and tonsils if necessary. It would be well if the orthodontist were as competent as the average rhinologist to make diagnosis of nose and throat conditions,—you notice that I say rhinologist, and not physician, for sometimes our patients will consult the family physician instead of the rhinologist, and bring a clean bill of health as far as nose and throat conditions are concerned, and we find that the child is suffering from nasal obstruction. Then, too, the orthodontist would be better able to advise the patient and would understand the conditions with which the rhinologist has to contend, and be less inclined to blame the rhinologist while struggling to correct the malocclusion of an unusually obstinate mouth-breather.

The rhinologist is dependent upon the orthodontist in many cases. The best informed operators will not do an adenoid or tonsil operation, after the adenoid tissue has caused mal-development of the bones and tissues of the nose and mouth, without explaining how futile it is to hope for any great benefit unless the patient also receive orthodontic treatment. In younger patients suffering from a deflection in the cartilaginous portion of the septum, the operator will ascertain if the maxillary arch should be widened to allow the nasal cavity to develop and the septum to straighten before an operation is performed. It would also be well if the rhinologist were as competent to make diagnosis of malocclusion of the teeth as the average orthodontist,—not dentist, for the average dentist is no more competent to make diagnosis of these conditions than the average physician is of nose conditions. I believe that the time will soon come when there will be a chair of orthodontia in medical schools, especially post-graduate schools of laryngology and rhinology, just the same as there are chairs of rhinology in our best schools of orthodontia. Then reasons for the continuance of mouth-breathing after operation in many cases will be understood and habit will not be made the scapegoat.

Today, our patients are not receiving the full benefit of modern science unless they have an opinion from both the rhinologist and orthodontist. The practitioner who, in the cases we have discussed, does not bid the patient consult the other specialist, be he orthodontist or rhinologist, is occupying a position that is indefensible.

APPENDIX.

To bring the case shown in Figs. 6 to 10 up to date, Figs. 12 and 13 are added. These give an idea of the improvement in occlusion of the teeth; the continued broadening of the dental arches; the development of the pro-

Fig. 14.

Fig. 15.

Fig. 16.

Fig. 17.

cess over the roots of the teeth; also the improvement in the angle of inclination of the maxillary teeth. All these are brought about by placing the teeth in normal relations and establishing normal functions.

Fig. 14 shows the face of the young man as it appeared when the

models, Fig. 6, were made. Note the lack of development and weakness of the lower part of the face. Fig. 15 shows the face directly after the active period of treatment. Note the over-development of the lips due to their abnormal exercise over the old form of appliance; also to the tipping out of the teeth at an abnormal angle. Fig. 16 shows the improvement in features four years later. Development of the lower part of the face is now nearly normal. Fig. 17 shows the young man's face as it is today. Note the fine balance of the features and the strength of character shown. There would have been no possible chance for the young man to have attained this fine development with his original condition of crippled masticating apparatus and deformed maxillary bones. February 11, 1915, Dr. Carmody reported nasal conditions and breathing space normal.

In regard to the young lady whose case is shown in Figs. 2 to 5, the orthodontist under whose observation she is at the present time reports continued improvement.

BIBLIOGRAPHY.

Edward H. Angle:—"Mal-occlusion of the teeth."

E. A. Bogue:—"The influence, on development, of arranging irregularly placed teeth into normal positions."

Nelson M. Black:—"Relation between deviation of nasal septum and irregularities of teeth and jaw from a rhinologist's standpoint."

G. V. I. Brown:—"Readjustment of the superior maxillae in treatment of hair-lip and cleft-palate."

Frank M. Casto:—"The necessity of orthodontic interference in malformation of the dental arches and maxillae."

Lee Wallace Dean:—"The influence on the nose of widening the palatal arch."

B. Frank Gray:—"The perversion of forces in and about the oral cavity."

Frederick S. Mc Kay:—"The correction of deformities of the maxillae as a prophylactic measure."

James David McCoy:—"The relationship of adenoids and enlarged tonsils to deformities of dental arches, maxillary bones and adjacent bony structures."

Frederick B. Noyes:—"The relation of the teeth to the development of the jaws and face."

Albin Oppenheim:—"Tissue changes, particularly of the bone incident to tooth movement."

Eugene S. Talbot:—"Etiology of face, nose and jaw deformities."

Eugene S. Talbot:—"Bone pathology and tooth movement."

Also correspondence upon the subject from over fifty orthodontists.

THE TECHNIC OF ACCURATE IMPRESSION TAKING.

By Samuel J. Lewis, D.D.S., Kalamazoo, Mich.

THERE seems to be so much contention among orthodontists at the present time as to methods employed, and materials used, in taking impressions of the jaws that the writer has deemed it timely and necessary to prepare this treatise. It is written with the hope that it may point out a way to improve the technic of those operators who have been negligent in this all-important part of practice, and also to defend the use of plaster as an impression material.

Accuracy should be the watchword of the orthodontist, whether he is taking an impression or cementing a band, and in no department of his work should each step be taken with more care than taking the impressions with which to produce a record set of models. Models are valuable only in proportion to their accuracy, and accurate models can only be made from impressions that are taken in plaster of paris.

The writer has heard directly and indirectly that it is possible to get as good, if not better, results by using modeling compound as an impression material, but he has failed, so far, to see any of these results. On the other hand, among the most successful orthodontists, one will find plaster used exclusively for impressions, where record models are to be made. While modeling compound is an excellent material with which to get a reproduction, we know that it is impossible to remove an impression, made in this material, from the mouth without distortion, except, perhaps, in some deciduous jaws. In view of this fact, and knowing as we do that accurate models are necessary for the proper study and planning of treatment, it is obvious that there is only one material that is adequate, and that is plaster of paris. Dr. Martin Dewey in his work on orthodontia, states that modeling compound has a place in dentistry, but not in orthodontia, and the writer concurs with him fully.

If the reader will spend a little time and thought mastering the following technic of taking impressions, or a modification of the same, it will be found that it is not as difficult an operation as it may seem.

Preparation of the Patient.

Before one should attempt to make an impression of either jaw, a thorough examination of the mouth should be made to ascertain the condition of the soft tissues, the existence of cavities in the teeth, loose teeth, missing teeth, the presence of a soft deposit around the necks of the teeth; in fact the general condition of the mouth as a whole. If any of these conditions exist, they should be remedied, otherwise accurate results are impossible. Even though everything seems to be in a perfect condition, the teeth should be polished so as to remove all foreign material; but the impression should not be taken immediately after this is done. The reason for doing this is that immediately after the polishing process, there is more or less blood present, and the natural lubrication of the teeth has been removed, leaving a condition which is not conducive to good results. A few hours, at least, should elapse before the impression is taken.

In examining the mouth, the best position of the patient is a straight one, having the jaw to be examined on a level with the eye. Either a Dunn speculum, or a mouth mirror is used, so that every part to be reproduced can be seen. When this is done, a mild alkaline wash is sprayed over the entire mouth, and a stream of air directed at the free margin of the gum of all the teeth. This causes the gum to stand away from the teeth, and by the time the operator is ready to take the impression, the margin will have returned to its normal position, and will allow a very accurate reproduction.

FITTING THE TRAYS.

The mouth being properly prepared, the next step is fitting the trays. While this seems a simple thing, lack of attention here will give rise to poor results.

Trays are made in many sizes, by various firms, but they must be fitted to every individual mouth before an accurate result can be had. A tray is chosen about the size needed for the upper jaw, and is introduced in the fol-

Fig. 1—Showing the upper tray in position when introducing it into the mouth.

lowing manner: The operator stands in front of the patient with the tray grasped in the right hand; the right corner of the mouth is drawn outward with the forefinger of the left hand, and the right heel of the tray placed in the left corner of the mouth (Fig. 1). By a rotary movement, the left heel of the tray can easily be placed in the mouth, and the tray gently pushed back to engage the tuberosities. The anterior part of the tray is then tilted downward so that the relation of the tray to the tuberosities can be seen; then it is tipped upward and pressed gently until the teeth touch the bottom of the tray. If the patient experiences any pain from pressure, the places causing it are trimmed until the tray will rest in that position without a feeling of discomfort. It is also necessary to note whether or not there is sufficient space between the lateral walls of the tray and the buccal teeth, for either too much or too little space is not good. The space should measure about one-fourth of an inch. The tray should not press against the buccal muscles and mucous membrane, nor should it extend too high anteriorly so as to interfere with the frenum labium. There should also be plenty of space

for the plaster all around the teeth and jaws so that no portion of the impression will be too thin. If so, this will interfere materially when the impression is to be removed from the mouth.

The upper tray being properly fitted, the lower one is tried in. As the lower trays, especially the Angle trays, are too narrow antero-posteriorly, a notch is made on the lingual portion, and the parts overlapped. This will give more room for the plaster immediately behind the incisor teeth, and will be of great benefit when removing the impression. The lower tray is placed in the mouth in exactly the same manner as the upper, with the exception that it is tilted upwards so that the posterior angles of the jaw may be seen.

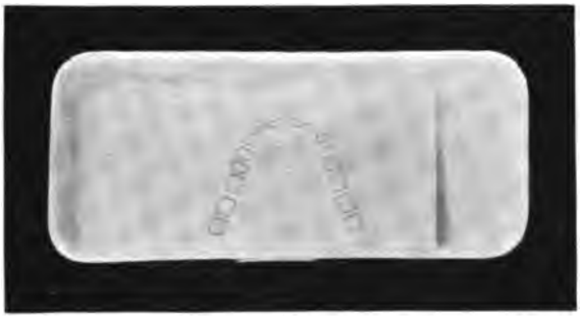


Fig. 2—Tray and diagram on which pieces of impression are laid.

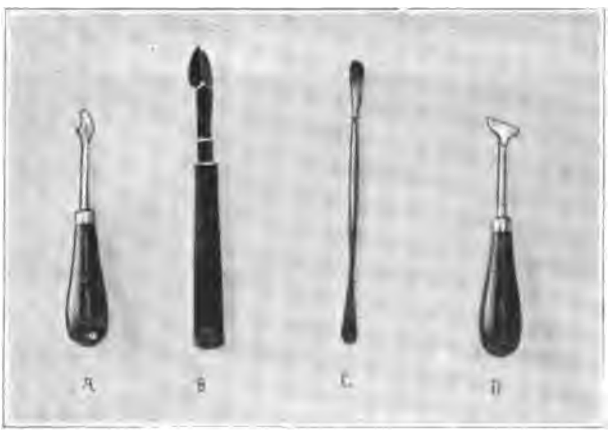


Fig. 3—Instruments used in impression taking. a, Lane Groover; b, Grunberg Groover; c, Grunberg Applicator; d, Lane Separator.

It is then tilted downward until the incisal and occlusal surfaces of the teeth touch the bottom. The sides are trimmed in exactly the same manner as the upper, so the tray will rest comfortably in the mouth. The trays are then laid aside until needed.

ARRANGEMENT OF INSTRUMENTS.

The auxilliary instruments used are a tray and diagram devised by Dr. W. S. Watson (Fig. 2), a Grünberg applicator, a Lane or Grünberg groover, and a Lane separator (Fig. 3); a mixing tray and plaster holder (Fig. 4); a mouth mirror, a pair of college pliers, and a few pieces of Japanese bibulous

paper. These should be placed in advantageous positions so that they may easily be reached, either by the operator or the assistant. The writer prefers to have everything but the plaster holder, mixing tray, and impression trays on the bracket table, as they may easily be reached with the right hand.

UPPER IMPRESSION.

The patient is placed in an upright position with the head tipped slightly forward. This will help to prevent any excess plaster from flowing into the pharynx, and will largely do away with gagging. The patient is covered with a large napkin, and a rubber bag is tied around the neck, as shown in the illustrations. This will catch any saliva that may trickle out, and will serve as a receptacle to place any small fragments of plaster in. A small

Fig. 4—Mixing tray and plaster holder.

A B

Fig. 5—Showing plaster in trays preparatory to inserting them in the mouth.

quantity of vaseline is rubbed over the lips of the patient to prevent them from drying, and so causing unnecessary pain. The plaster is then sifted into the small shallow dish (Fig. 4) containing a little warm water, and when the dish can be turned upside down without the plaster running out, the plaster will be of the proper consistency. The tray is then filled in the following manner: the spatula, which should be quite large, is filled with plaster, and this placed on one side of the tray, from the median line to the heel. With another spatula full, the opposite side is filled, a third portion, not quite as large as the second, being placed anteriorly, but not covering the outside of the tray (Fig. 5A). (The plan of extending the plaster onto the handle of the tray has been discarded by most operators, as it leaves a messy area.)

When the tray has been filled as described, the operator steps in front

Fig. 6—Showing method of holding upper lip away while placing plaster in the embrasures.

Fig. 7.—Showing position of the forefinger after the upper tray is placed in the mouth.

of the patient, while the assistant stands on the left side with the mixing dish in her hand. The patient is told to relax the muscles, and to open the mouth slightly while the operator works the soft plaster all over the buccal

Fig. 8—Showing position of the left middle finger after the operator steps to the rear of the patient.

Fig. 9—Showing grooves in the plaster and method of holding the lips away and using the Lane separator.

and labial embrasures with a suitable instrument, such as the Grünberg applicator (Fig. 3C). When working the plaster around the labial embrasure, the lip is held away with the thumb and index finger of the left hand

(Fig. 6). This being completed, the filled tray is taken in the right hand; the right corner of the mouth being drawn upward and outward with the index finger of the left hand, and the right heel of the tray placed in the left corner of the mouth (Fig. 1). Now by a slight rotary movement, the tray is placed in the mouth, and adjusted carefully at the tuberosities. The tray is then tilted upwards so as to engage the anterior teeth, and with a slight upward and backward movement, it is pushed home, care being taken, however, that the tray is adjusted so that both lateral walls stand equally distant from the buccal teeth. Otherwise, when the impression is removed, it will not be symmetrical. The upward and backward pressure will cause the plaster in the tray to flow backward, expelling any air or excess plaster, which can be removed with a small mouth mirror. The tray now being in its proper place, the index finger of the right hand is placed in the palatal

Fig. 10—Showing the anterior part of the impression removed.

portion (Fig. 7), and while being held firmly, but gently, the operator steps to the rear of the patient. The left middle finger is now substituted for the right index finger (Fig. 8), and the lips and cheek pulled out gently so that the plaster in the embrasures will be properly distributed. The tray is held in position with the left middle finger until the plaster has hardened. The time for this depends upon the kind of plaster used, and also the weather conditions, but usually about five minutes will be sufficient. During the setting process, the tray must be held firmly, as any slight movement will cause an inaccurate result.

When the plaster has hardened sufficiently, any excess on the outside of the tray is removed with a pair of college pliers. The operator, standing in front of the patient, then grasps the handle of the tray firmly between the thumb and index finger of the right hand, and tips the tray downward until

there is a separation anteriorly. Then, by pushing the tray upwards, the heels are disengaged, and the tray removed from the mouth by a rotary movement. The mouth is then swabbed with small tampons of cotton, removing all small particles of plaster, and the periphery of the mouth cleaned. The upper lip is now held with the thumb and the forefinger of the left hand, and the impression grooved horizontally in the region of the cuspid teeth with either a Lane groover (Fig. 3A) or a Grünberg groover (Fig. 3B). This groove should not be too wide or too deep, and should not extend quite through the plaster (Fig. 9). A Lane separator (Fig. 3D) is placed in the groove on one side, and turned slightly outward until a break is heard. It is then transferred to the opposite side, and this movement repeated. This will usually break off the anterior portion (Fig. 10), although this operation may have to be repeated several times before this piece can be dislodged. Unless the operator holds the entire lip away from the impression, the anterior portion may split in two, or more parts.

After the anterior portion of the impression is removed, the right thumb is placed against the left lateral, buccal half, and, with a downward and out-

Fig. 11—Showing the parts of the impression in their respective positions on the Watson diagram.

ward pressure, that half is dislodged and removed; likewise the right side. All that remains now is the palatal portion, which may be removed by a slight rocking motion, and usually it will come out *en masse*. The parts are placed in a suitable tray, containing a Watson diagram, and any small fragments that remain in the mouth can be removed with pliers, and placed in their respective positions (Fig. 11). This tray is then placed away, and the fields of operation cleaned preparatory to taking the lower impression.

Lower Impression.

The tray being already fitted, the first step is to place the patient in the proper position. The chair is lowered more than when taking the upper impression, and is tilted back to an angle of sixty degrees. The operator stands in front of the patient when applying the plaster to the embrasures, and when placing the tray in the mouth. The following steps are the same as when taking the upper impression, and so need no further explanation. However, after the tray is fixed in the mouth, it is held firmly by placing the index finger of the left hand immediately over the region of the incisor teeth.

With the right hand, the cheeks and lips are manipulated so that the plaster in the embrasures will be properly formed. Then a few pieces of bibulous paper are packed under the lingual surface of the tray to prevent the saliva from attacking the plaster, also to force any excess away from the tray. The operator then steps to the rear of the patient, being careful, however, not

Fig. 12—Showing method of holding the lower tray after it is placed in the mouth.

Fig. 13—Showing method of holding the lower jaw when removing the lateral halves of the lower impression.

to displace, or move the tray, and places the thumb of the left hand over the region of the premolars, grasping the lower border of the jaw with the forefinger. The right hand is now placed in the same position on the right side (Fig. 12) and the plaster allowed to set. If there seems to be an over-abundant flow of saliva, it is sometimes advisable to administer 1-150 grain of

Atropin one hour before the appointment. This will act upon the salivary glands, lessening their secretions.

When the plaster has set, any excess on the outside of the tray and in the lingual portion is removed, also the pieces of bibulous paper. The tray is removed by grasping the handle firmly between the thumb and forefinger of the right hand, and tipping it slightly upward. This will disengage the tray from the plaster so that it can be removed from the mouth by a slight rotary movement. The mouth is then swabbed with tampons of cotton, so that all surfaces are free from viscid saliva, and particles of plaster. The grooving is done as in the upper, only when removing the lateral buccal halves of the impression, the jaw is held firmly by placing the thumb of the left hand behind the angle of the jaw on the right side, and the forefinger behind the angle of the jaw on the left side (Fig. 13). This holds the jaw stationary, so that the parts can be easily removed.

Fig. 14—Showing plaster plug in position.

The lingual part of the impression can be removed, sometimes, in two parts, but more often in three. These lateral halves are broken by placing the thumb of the right hand against the area of the buccal teeth and pushing slightly downward and lingually. As these parts are removed, they are placed in their proper positions on the tray. If the parts break so as to leave a portion of plaster in the region of the lingual surfaces of the incisor teeth, this part can be removed by tilting it backward with a pair of pliers.

The pieces having been removed and placed in the tray, the mouth is sprayed, the face washed and the patient dismissed.

Taking Impressions Where Teeth Are Missing.

Where there are teeth missing, especially where the molars have tipped forward, leaving a V-shaped space, it is sometimes very difficult to separate

the impression, bringing out all of the pieces accurately. This can be overcome by making a small plaster plug to fit the space before the impression is taken. This is done by placing some plaster in the space, and allowing it to set, after which it is trimmed so that it can be removed buccally (Fig 14). It is then removed, shellaced and varnished, and coated with vaseline. Before taking the impression, this plug is placed in position, when the technic following is the same as when taking the other impressions.

IMPRESSION TO ASCERTAIN NORMAL MESIO-DISTAL RELATION OF THE MOLARS.

Sometimes, when treating Class II, or Class III cases, it is advisable to study the relation of the molars as the lower jaw is being shifted mesially or distally, and this can be done in a very simple way. The patient is told to close the jaw naturally, and tip the head to one side so as to keep the saliva from running into the plaster. The cheek is held out with a Dunn speculum, and soft plaster worked around the buccal teeth. It is made thick enough so that it will not fracture when being removed. When it is set thoroughly it can be removed in one piece (Fig. 15), and a model made from it.

Fig. 15—Impression of buccal surfaces of premolars and molars for studying mesio-distal relation of molars during treatment.

IMPRESSIONS FOR MAKING RETAINERS.

After the necessary bands are placed on the teeth, a tray which has been cut down, filled and roughened on the inner surface, is filled with plaster, and placed in the mouth in the same manner as when taking the other impressions, the only difference being that the tray is pushed down so that the plaster extends about one-eighth of an inch below the free margin of the gum. This permits it being removed *en masse* with the bands in position. A little melted wax is then flowed around the inner surface of the bands, preparatory to pouring the model. This allows the bands to be removed after the model is run, and is very advantageous when making a removable retainer.

CONCLUSION.

The foregoing covers all the technic of impression taking that is necessary in the majority of cases, and the reader, if interested in the technic of placing the impressions together and making the models, is referred to the writer's article on the "Technique of Accurate Model Construction," which appeared in the March, 1915, number of the *Journal*.

THE HISTORY OF ORTHODONTIA.

(*Continued from page 635*)

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NEW YORK CITY.

The Medieval Period.

MEDICAL history, according to Nicarsi, during the Middle Ages was divided into four periods—the Arabian, covering the period between the fifth and eleventh centuries, the Salernitan (eleventh and twelfth centuries); the pre-Renaissance period of the Crusades (twelfth to fourteenth centuries), and the Monastic and Scholastic periods (fifteenth and sixteenth centuries).

The Arabians derived their knowledge of Greek Medicine from the Nestorian Monks, the practical details from the Jews, and their astrological lore from Egypt and the far East. They abstained from dissecting because of religious convictions, and left operative surgery and venisection to the wandering specialists.[1] They were loyal supporters of all the sciences and were instrumental in founding hospitals, libraries, and schools. Perhaps the first hospital established was that at Misr in Egypt in 597, but not until the time of the Arabians did medical science make great headway in this respect. Medical instruction was given at either of the great hospitals at Damascus, established in 707 A.D., Cairo (874), and Bagdad (918). The principal courses were clinical medicine, pharmacology and therapeutics. Anatomy and surgery were neglected, but chemistry was held in high esteem.

As the Greeks and Romans were displaced by the Saracens, so in turn came the Turks to destroy and succeed them. The thirteenth century established the supremacy of the Ottoman Empire and Palestine was made a possession of the Turks. This led to the wars of the Crusades. Medical practice during these days retrograded, and the end of this period found medicine confined to the narrow limits of the early Greeks. The change of Constantinople from Roman control to that of the Turks, led to the expulsion of scholars from the East, and the settling of these men of great learning in the West, later to become teachers of their arts and sciences, and laid the foundation for new development and advancement through original research.

As the power of the Roman Catholic Church increased, and monkish orders were established, the monastaries became the centers of surgical and medical practice. However, in 1163, the clergy was forbidden by the authorities of the Church to practice the surgical side of medicine, as it was found that the acceptance of medical fees, the sight of many aspects of the sick that might offend modesty, the possibilities of being the cause of a patient's death, or other happenings, were somewhat inconsistent with the original intentions of holy orders.

However, there were some who assumed the duties of minor surgery and the extraction of teeth. In the course of time many of these separated themselves from the monastry, and practicing entirely among the laity, established the profession of barber-surgeons. An early as 1308 we find the

1. Garrison: History of Medicine, p. 91.

barbers united into one guild with the surgeons, and the English name of barber-surgeons for several hundred years embraced the practitioners of all the special branches of surgery.

The thirteenth century was remarkable for the impetus which was given to literature and the arts. Through the invention of paper, and later through the invention of printing presses, a new era was opened in medicine. The foundation of the earlier universities, which succeeded the older monastic colleges of Salerno and Monte Cassino, did a great deal to improve matters. Later schools were established in Valencia, Paris, Toulous, Prague, and Vienna.

From the thirteenth to the sixteenth century dentistry made but little progress. We find that the doctors and surgeons in general were little skilled in dental diseases. As one physician, Giovanni of Virgo, expressed it: "For the extraction of teeth there is needed a practical man, and therefore, many medical and surgical authorities expiessed an opinion that this operation

Fig. 1.—From the Melerstat edition of Mundinus (Leipzig, 1493).

Fig. 2.—Title page of the Mundinus by Berengarius (1521).

should be left to expert barbers and to the itinerant quacks who operate in public places. He, therefore, who desired to perform this manual operation in the best manner, will derive great advantage by frequenting men who are experts in performing it, and by seeing and impressing well on his memory their manner of operating."

We do, however, find among the writings of several of the Italian professors of medicine and surgery some description of dental diseases in their treatment.

Of these writers several names stand out brightly on the scroll of the history of dentistry.

Bruno of Longobucco (1252).

Lanfranchi (1300) who recommended the use of narcotics and was not at all favorable to the extraction of teeth.

Theodorico Borgognoni (1205-1298) advised that in every case where a fistula of the gums exists, or in general of the maxillary region, special attention should be paid to the condition of the dental roots.

The title of "doctor" was first used in the twelfth century, at the establishment of the universities, and indicated a learned man in any science. The term "doctor of medicine" was first applied to William Gordini in 1329, by the college at Asti, in Italy. It was not until 1622, however, that "surgeon-dentist" was bestowed, a number of men in France, notably Gillies, receiving the title during that year.

Anatomy was advanced by *Remondino* or *Mindino de 'Luzzi* called *Mundinus*, whose *Anatomia* was completed in 1316 and first published in Padua in 1478. This treatise, "*Anatome omnium humani corpus interiorum membrorum*," was the first treatise founded on the actual anatomy of the human body, having this advantage over the works of Galen, who had very little, if any, practice in human dissection, doing most of it on apes.

This work was brought out during the fourteenth century, passing through many editions in Bologna, Leipzig, Venice, Strassburg, Lyons, Pavia, and Marbourg, and has been esteemed as classical literature in Italy, where it was used for a long time as a text-book. It has also the distinction of being the first anatomical work in which wood engravings were used as illustrations. From this period on every university adopted the habit of dissecting one or two human subjects every year, a barber being generally charged with this operation while a professor demonstrated the several organs from the work of Mundinus.

Guy de Chauliac (1300-1370) was the most celebrated surgeon of the fourteenth century. His work on surgery, "*Inventarium sive Collectorium partis Chirurgicalia Medicinæ*", obtained as great a degree of fame in France, as did that of Mundinus in Italy, and which, even up to the eighteenth century, "was, as it were, the official code for teaching of surgery." It was a clear explanation of much confused matter, which had been written by his predecessors in the dark ages, and "caused Fallopius to speak of Chauliac as the first legislator in surgery, as was Hippocrates in medicine."

From de Chauliac's work we obtain a clear and concise idea of the condition of dentistry during the fourteenth century. We find that this branch made but little progress from the time of the Arabians to that of Guy de Chauliac, over two and a half centuries; and even this great surgeon contributed little worthy of note to the development of dentistry.. On the anatomy and physiology of the teeth he expresses himself very briefly. In regard to the pathology and therapy of the teeth his ideas are the same as the Arabian writers. The chapter on the extraction of teeth is simply a summary of what Albucasis wrote.

"The Arabian surgeons treated rather lengthily the deformities of the dental arches, and the methods employed in correcting these. Guy de Chauliac almost entirely neglects this subject and limits himself to saying that if any tooth becomes abnormally lengthened, it is necessary to reduce it to the right length with the file, but operating 'wisely' so as not to loosen it."

Pietro de Argelata of Bologna (1433) in his treatise on surgery, in six books, writes along similar lines, and also recommends the use of strong acids for cleaning carious cavities of the teeth.

Giovanni Plateario (1470), Professor at Pisa, rcommends the sitting posture as the most convenient for the patient during the operation, evidently an innovation.

The last writer of this period to be mentioned is worthy of note—*Giovanni Arcolani*, professor at Pauda and Bologna (died 1484). *Practica*, his treatise on surgery, is memorable as one of the leading pioneers of dentistry and surgery of the mouth. His work contains many illustrations of instruments used at the time. He wrote at length and with originality on the subject of teeth, recommending the use of thin gold leaf for filling carious cavities, first cleaning the cavity with a strong acid. This is the greatest advance thus far towards conservative dentistry, although he himself was not the first to use this method.

Sixteenth Century.

Not until the sixteenth century do we see any great progress made in dentistry. During this period we find the revival of the arts and sciences,

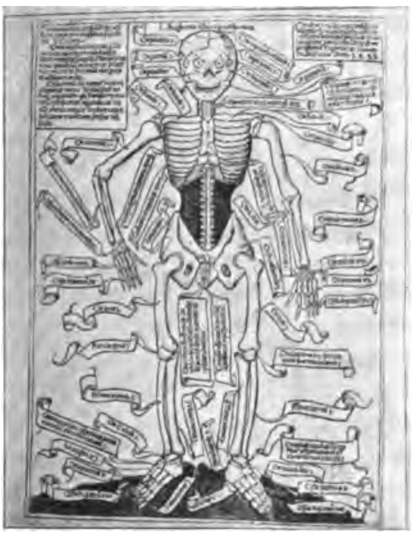


Fig. 3.—Conception of anatomy. R. Helain (1493).

Fig. 4.—Anatomical sketches from Phryesen's Spiegel der Artzney (1517).

the translation of the early Greek works into Latin, and the great improvement in printing by means of movable letters. All this had a well defined bearing on the advancement of medicine and dentistry.

The greatest progress, however, was made in anatomy. Every part of the human body was carefully studied and many important ideas were revealed, contributing to the establishing of the science of medicine.

Among the great physicians of this period, and important additions to medicine, we find the following:

Gabriel de Zerbi (1502) was the first to describe the uvea of the eye; the first pair of cerebral nerves; and the fallopian tubes.

Achillinus (1516) gave the first correct description of the valves of the cecum; the whartonian ducts of the submaxillary glands; two of the small

bones of the ear, the malleus and the incus; the veins of the arm; the infundibulum of the brain; the fourth pair of cerebral nerves; and the vermiform appendix of the cecum.

Berenger de Carpi (1518) is supposed to have dissected over one hundred bodies. In his works he describes the separate cartilages of the larynx; the tricuspid valves between the right auricle and ventricle of the heart; and the semilunar valves at the commencement of the pulmonary artery.

Nicholas Masson (1536) showed the peritoneum to be a closed sac and formed one continuous membrane.

Charles Etiene (1536) described the distinction between the penumogastric and sympathetic nerves, the valves of the veins; the three branches

Fig. 5.—Title page of Zahnarzneybuchlein. First work pertaining to the care of the teeth. Dr. E. C. Kirk's edition.

of the fifth of cerebral nerves; and the canal of the spinal cord along its entire course.

James Sylvius; Jacques Dubois (1540) was the master of Vesalius and one of the earliest known anatomists of France. He was the first to inject the blood vessels, to describe the pterygoid and clinoid processes of the sphenoid bone and the transverse and oblique processes of the vertebræ, the externus oblique and transversalis of the abdomen muscles, and the external jugular veins.

Ambroise Paré (1543) was the greatest surgeon of the century. He introduced into France the application of ligatures to arteries for the purpose of arresting hemorrhages.

Ingrassius (1544) described the two tympanic foramina; the tympanic portion of the Vidian nerve "Chorda tympani;" and the mastoid cells, as forming part of the ear, the cochlea and the semicircular canals.

Michael Servetus (1546) was the first to comprehend the lesser circulation, that which passes through the lungs.

Faliopius (1561) first described the aqueduct of Fallopius, containing the chorda tympani, the labyrinth and tympanum; several muscles of the neck; the occipito-frontalis, the external pterygoid, geniohyoideus, and all the muscles between the hyoid and the lower jaw.

Vidus Vidius (1561) demonstrated the aqueduct of Sylvius; Vidian canal and Vidian nerve.

Eustachius (1563) described the structure of the teeth, the Eustachian tube of the tympanum; the thoracic duct; the Eustachian valve between the openings of the superior and inferior vena cavæ.

Until the year 1530 medicine and dentistry were included under one head. According to Crowley's "Bibliography" it was not until 1536 that we find the first publication in dentistry. During that year the work entitled "*Zahnarzney*" appeared, being published in Frankfort, Germany, but without the author's name. As far as known the earliest work pertaining to the study and care of the teeth, is the edition by Michael Blum "*Artzney Buchlein*", published in Leipzig in 1530, and now in the library of Dr. E. C. Kirk.

In 1536 the first edition by Charles Egenloff was issued. This work is perhaps most interesting to us, as it contains several paragraphs dealing with the treatment and correction of irregularities of the teeth.

The unknown author of this little work says, "It often happens to children more than seven years of age, when the teeth begin to drop out; that other teeth grow by the side of those which loosen the tooth about fallen out from the gums, and move it often to and fro until it can be taken out and then pushed the new one every day on towards the place where the first one was until it sits there and fits in among the others, for if you neglect to attend to this, the old teeth will remain, turn black, and the young one will be impeded from growing straight, and can not more be pushed to its right place." We are lead to believe by this statement that the mechanical principles of regulating appliances were not known at that time.

Later, in 1559, a book "Zahn Artzeni"[1] (tooth doctoring) was also published in Germany, but the author's name is not given. It is in text so much like the one published by Peter Jordon, in 1532, that it may have been a second edition of Jordon's book. It contains many curious observations.

"It frequently happens that when, in the seventh year, the teeth of children begin to drop out, the new teeth grow alongside of those that should fall out. In such a case the old tooth should be well separated from the gum and frequently shaken until it becomes loose enough to remove. After that the new tooth should be daily pressed in the direction of the tooth that has been removed until it has taken the place formerly occupied by the other one, and if this is neglected the tooth will become black, and it can never grow straight, and there is no way by which it can be put in its proper place afterwards."

1. Koch's History of Dental Surgery, Vol. 1, p. 23.

To *Walter Herman Ryff* (1548) honor must be given for the first important work devoted to dentistry. "*Nuetzlicher Bericht, wie man die Augen und das Gesicht, scherfen und gesund erhalten, die Zahne frisch und fest erhalten soll.*" (Useful instruction on the way to keep healthy, to straighten and reinvigorate the eyes and the sight, keeping the teeth clean and retaining them.)

There was little original material in it, the principal merit consists in the fact that it was the first book that was written in German and not in Latin, and may be looked upon as the earliest work endeavoring to impart to the people knowledge of medicine, dentistry, and hygiene.

The pamphlet, printed in Wurzburg, is made up of sixty-one pages, and is divided into three parts, the first of which is dedicated to the eyes, the second to the teeth, and the third to first dentition.

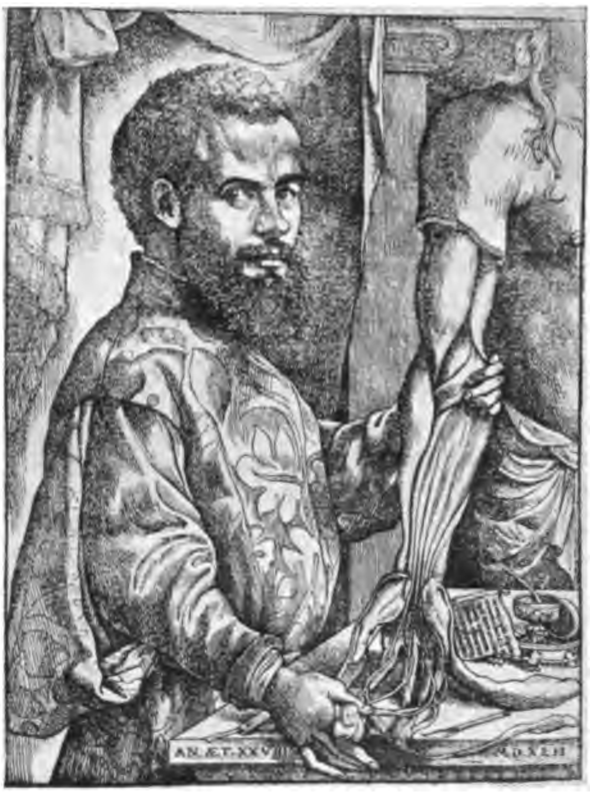


Fig. 6.—Andreas Vesalius (1514-1564).

Andreas Vesalius (Brussels, 1514) came from a family of physicians. Making rapid progress in medical science, he soon became professor of anatomy at Padua, and by skillful work with the dissecting knife and keen perception he brought forth his remarkable work on human anatomy, "*De Corporis Humani*" (1543), the first comprehensive and systematic description of the human body. In this work we find the first plates and beautiful illustrations executed from nature.

His system of anatomy is not complete, nor is it accurate, but must be

considered wonderful, when we consider the conditions under which it was accomplished. He describes the osseous system: was the first to discover the internal pterygoid; the vocal chords of the larynx; the glandular structure of the stomach; the coronary arteries of the heart, as well as several other arteries; the cervical and sacral plexuses of nerves.

On the fly leaf of a copy of Vesalius' work, formerly in the library of Dr. William Osler, but now in the New York Academy of Medicine, Dr. Osler has written: "The greatest medical book ever printed, from which modern medicine dates."

"Although he gave little attention to dental matters, Vesalius fully deserves a place of honor in the history of dentistry, for this, like every other branch of medicine, received great advantage from his reforming work which broke forever the authority of Galen, thus freeing the minds of medical men from an enslavement which made every real progress impossible."

Fig. 7.—Title page, Anatomy of Vesalius.

"Before Vesalius, Galen's anatomy had served as a constant basis for the teaching of this science." In his great work, beautifully illustrated, the anatomy of the teeth is treated with less consideration than that of the other parts of the body. However, his description of the dental art is far more accurate than that of Galen. In his chapter on the anatomy of the teeth appear several well drawn figures, one showing the section of the lower molar, with the pulp cavity and the two root canals; another the upper and lower teeth of the right side, in occlusion, showing clearly the general shape, and length and number of roots.

"In regard to roots, he makes, for the first time, a very clear distinction between the premolars (small molars) next to the canine and the other three, and says that the former in the upper jaw usually have two roots, and in the lower, only one; whilst the last three upper molars usually have three roots and the lower ones two.

"The canines are, of all the teeth, those which have the longest roots. The middle upper incisors are larger and broader than the lateral ones, and their roots are longer. The roots of the last molars are smaller than those of the two preceding molars. The molars are not always five in each half jaw; sometimes there are only four either on each side, or one side only, in only one jaw or in both. Such differences generally depend on the last molar, which does not always appear externally, remaining sometimes completely hidden in the maxillary bone, or only just piercing with some of its cusps the thin plate of the bone which covers it."

Gabriel Fallopius (1562), another great physician of the period, did not however limit his investigations to anatomy and surgery, but also to plants and animals. He was better acquainted with the ear than any of his predecessors, and, as previously noted, was the first to describe the aqueduct of Fallopius containing the chorda tympani; the labyrinth and tympanum; and several muscles around the head and neck. "He carried out accurate and successful research in regard to the development of the teeth. His investigations enable him to show the falsity of the opinion held by Vesalius, that the permanent teeth are developed from the roots of the temporary ones. He was, besides, the first who spoke in clear terms of the dental follicles."

The teeth, says Fallopius, "are generated twice over, that is, the first time in the uterus, after the formation of the jaws, and the second time in extra-uterine life, before the seventh year. The first teeth are, at the time of birth, still imperfect, without roots, completely enclosed in their alveoli, and formed of two different substances; the part with which they must break their way out is osseous and hollowed, the deeper part, instead, is soft and humid and is seen covered with a thin pellicle, a thing which may also be observed in the feathers of birds when they are still tender. In fact the part of the feather which comes out of the skin is hard and corneous, while the part which is embedded in the wings is soft and humid and has the appearance of coagulated blood or mucus. So also in the fetal teeth, the part corresponding to the future root presents itself like coagulated mucus. Little by little this soft substance hardens and becomes osseous, thus constituting the root of the teeth."

Fallopius' reference to the analogy between the development of the teeth and that of feathers was highly important, as a point of departure for embryological researches which showed clearly the real nature of teeth, thus destroying the mistaken idea held by Galen and many other authors that these organs were bones.

On coming to speak of the teeth generated in extra-uterine life, that is of the permanent teeth, Fallopius relates having observed that they have their origin in the following manner: "A membranous follicle is formed inside the bone furnished with two apices, one posterior (that is to say, deeper down, more distant from the surface of the gums), to which is joined a small nerve, a small artery, and a small vein; the other anterior (that is, more superficial) which terminates in a filament or small string like a tail. This string reaches to the gum, passing through a very narrow aperture in the bone, by the side of the tooth which is to be substituted by the new one. Inside the follicle is formed a special white and tenacious substance, and from this the tooth itself, which at first is osseous only in the part nearest the sur-

face, whilst the deeper part is still soft, that is, formed of the above mentioned substance. Each tooth comes out traversing and widening the narrow aperture through which the 'tail' of the follicle passes. The latter breaks, and the tooth comes out of the gum, bare and hard; and in process of time, the formation of its deeper part is completed."

Bartholomeus Eustachius (1547), another great anatomist, spent considerable time studying the teeth, giving a full description of the different forms, numbers and varieties, indicating manner of articulation and the nature of the attachment of the teeth to their sockets.

In his monograph "*Libellus de Dentibus*" published in 1563 in Venice, we find the first treatise ever written on the anatomy of the teeth. Eustachius treats with great accuracy all that concerns the anatomy, physiology and development of the teeth.

"In Chapter IV, speaking of the means by which the teeth are held in their sockets, Eustachius mentions in quite explicit terms the ligaments of


BARTHOLOMAEI
EVSTACHII
SANCTOSEVERINATIS
LIBELLVS DE
DENTIBVS
Cum priuilegijs.
VENETIIS,
M D LXIII.

Fig. 8.—Title page of the edition of Eustachius. First work on dental histology (1563).

the teeth. He begins by saying that the perfect correspondence between the dental roots and the alveoli, both in shape and in size, is one of the elements which contribute to the firmness of the teeth, since the alveolus, being exactly applied, on all sides, to the root or roots of the teeth, cause the latter, by this simple fact, to be fixed in a determined position.

Ambroise Paré (1510-1590), the celebrated French surgeon, in his several works treats very thoroughly of the diseases of the teeth, and their cure. At the age of sixteen, we find him in Paris employed as a barber. Under these conditions he was able to acquire a vast experience in the practice of dentistry. In his writings he gives a fairly correct account of the teeth; their number, position and size; of their attachment to and connection with adjoining structures.

His anatomy is vague, and not nearly as exact as Vesalius or Eustachius. He, like some of his predecessors, believed that the teeth continued to grow until death, and that the wearing away was due to friction in mastication.

"In speaking of the development of the teeth, Ambroise Paré says only that "they are already solid and osseous before birth, he himself having observed this in dissecting the jaws of a child that had died immediately after birth."

"Toothache," says Paré, "is, of all others, the most atrocious pain that can torment man without being followed by death. It depends, in many cases, on a humorous fluxion of a hot or cold nature which flows into the alveolus, forcing the tooth outward, loosening it, and causing the patient so much pain on the slightest pressure being exercised upon it that he cannot dare to bite with it in the least. If, however, the tooth is corroded, hallowed out, or pierced to the root, the pain is so strong, when the patient drinks,

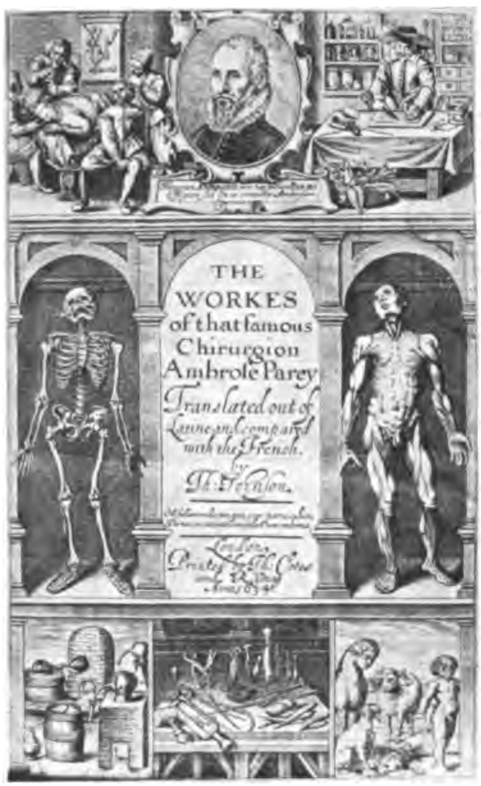


Fig. 9.—Title page of Ambroise Pare.

particularly if the liquid is cold, that he seems to have had a stab with a stiletto inside the tooth.

"If the pain is acute and pungent, like that produced by needles being thrust into the diseased tooth; if the patient complains of a strong pulsation at the root of the tooth, and in the temples; if the application of cold remedies calms the pain, all these signs indicate that the cause of the evil is heat. Instead, the cause of the pain may be held to be cold when the patient complains of a great heaviness in the head, emits a quantity of saliva, and finds a relief in the application of hot remedies. In the treatment of toothache one must fulfill the following three indications:

"1. Regulate fittingly the mode of living.

"2. Evacuate or dissipate the morbid humors; this may be effected by various means, namely, by purgatives, by bleeding, by gingival scarification, by the application of leeches on the site of the pain, by cupping on the back of the neck, or on the shoulders.

"3. Applying in each single case the medicaments best adapted for calming the pain.

"The extraction of a tooth should not be carried out with too much violence, as one risks producing luxation of the jaw or concussion of the brain and the eyes, or even bringing away a portion of the jaw together with the tooth (the author himself has observed this in several cases), not to speak of other serious accidents which may supervene, as, for example, fever, apostema, abundant hemorrhage, and even death."

COLOQVIO BREVE Y cōpēdioſo. Sobre la materia d la dētadura, y marauilloſa obra d la boca. Cō muchos remedios y auiſos neceſſarios. Y la ordē de curar, y adreçar los dientes.

¶Dirigido, al muy alto y muy poderoſo ſeñor el Principe dō Carlos nro ſeñor. Cōpueſto por el Bachiller Frācīſco Martinez. Natural de la villa de Caſtrillo de onielo. Eſtā te en Valladolid. 1557.
Con preuilegio.
¶Eſta taſſado en LVII. mrs.

Fig. 10.—Title page of F. Martinez (1557). Oldest Spanish work on dentistry.

Fig. 11.—Type of instruments used in 1585. From the work of J. Guillemeau.

Paré was, perhaps, the first to mention the use of the palatal obturator. He says, "Sometimes a portion of the bone of the palate is destroyed by the shot of an arquebus, or some other wound or by a syphilitic ulcer, the patient being thereby disabled from properly pronouncing words and from making himself understood. To repair this defect we have found an expedient through the help and ministry of our art. It consists of the application of an instrument somewhat larger than the palatal perforation; this is made of gold or silver, of about the thickness of a crown (coin), and has the form of a vaulted roof to which a sponge is attached; when introduced into the aperture, the sponge, absorbing the humidity natural to such parts, will very

soon swell up, and thus the instrument is held firm. In this way words are better pronounced."

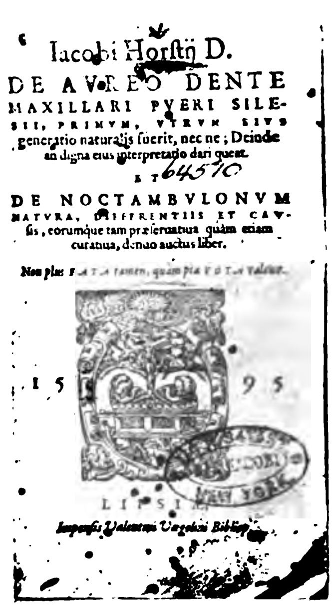
In case of difficult dentition, he advocates lancing of the gums, deeply, just above the tooth which is creating the disturbance, allowing the tooth to erupt easily.

In the correction of irregularities of the teeth, his method is similar to that of Celsus and others.

"If the persistence of a deciduous tooth should cause the cutting of a corresponding permanent tooth, outside the line of the dental arch, thus giving rise to deformity," Paré advises, "laying bare and then extracting the deciduous tooth; for after this the new tooth may be pressed towards the point before occupied by the other until it assumes its natural position."

He was undoubtedly one of the first to describe the process of trans-

Fig. 12.—Jacobi Horstii (1595). The story of the golden tooth.



Iacobi Horstij D.
DE AVREO DENTE
MAXILLARI PVERI SILESII, PRIMVM, VTRVM SIVE
generatio naturalis fuerit, nec ne; Deinde an digna eius interpretatio dari queat.
ET 64510
DE NOCTAMBVLONVM
NATVRA, DIFFERENTIIS ET CAVSIS, eorumque tam præseruatiua quàm etiam curatiua, denuo auctus liber.
1595
LIPSIÆ

Fig. 13.—Title page of J. Horstii (1595).

plantation though not from personal knowledge, but from report, and he mentions a case in which this operation was said to have been successful. He also gives a minute direction for the extraction of teeth, and a chapter on "the placing of teeth artifically made instead of those that are lost or wanting." In this he says, "Teeth artifically made of bone or ivory may be put in the place of those that are wanting, and they must be joined fast unto another and also fastened to the natural teeth adjoining that are whole: and this must chiefly be done with a thread of gold or silver, or for want of either, with a common thread of silk or flax, as it is declared at large by Hippocrates." Thus it appears that no improvement upon the Etruscan and Phœnician plans were in his time known to this author. The process of transplanting mentioned by Paré was strenuously advocated, more than two centuries later, by the distinguished physiologist, Hunter.

Fabricius of Aquapendente (1537-1619) follows the method of Celsus, advises great care in the extraction of teeth, and gives this method in correcting defects produced by irregularities: "When one or more teeth have appeared in an irregular position and offend the walls of the oral cavity or else the tongue, the excision (resection) of the tooth or teeth must be performed with a pair of strong pincers, whose shape must vary according to whether the teeth are situated externally or internally with regard to dental arches. But after the resection there will almost always remain some points or sharp irregularities, which by their presence would continue to irritate the soft parts, it will be necessary to remove these irritating prominences by means of a file."

In 1618 *Helkiah Crooke* published a curious and rare old work, "*Helkiah Crooke, Doctor in Physicke*", in which he reviews the work of the best anatomists, and indicates the character and extent of the physiological knowledge of his time. As to the teeth being bone he has the following to say: "That they (the teeth) are bones some men do deny, first, because bones are insensible, and teeth sensible. Secondly, because the bones have certain limits of action or increase, neither do they ever grow again if they perish, but in the teeth it is quite contrary. Thirdly, because they are harder than other bones. Fourthly, because bones exposed to the ayre do grow black, whereas the teeth do keepe their whitenesse.......... Finally, say they, there is a stone that will consume fleshe, called therefore, Sarcophagus, which within forty days will devour the whole body except the teeth. If therefore the teeth were of the nature of bones, they also would be consumed.

"They are made very hard that they might not ware so soone or be broken in the chewing or breaking of hard things, for they are not lined either with fatte or gristles as other joynts are to hinder attrition. The teeth, therefore, do breake bones, resist the edge of steele, neyther can they easily as other parts of the body be burnt with fire. Hippocrates in his booke, '*de Carnibus*' ascribeth the cause of their hardness to the quality of the matter out of which they are ingendered, for he writeth that out of the bones of the head and the jaws there is an increase of a glutinous matter. In the glutinous matter the fatty part falleth downe into the sockets of the gums where it is dryed and burnt with the heate, so that the teeth are made harder than the bones because there is not cold remaining in them."

He paid close attention to dentition and the influence of the deciduous teeth in producing irregularities, referring to conditions produced by supernumeraries on one hand and narrow arches on the other. His views seemed to have influenced succeeding investigators. On second dentition the author says: "The shearing (that is, the incisors) teeth, when they do break forth, do thrust the first shearers out before them and issue betwixt the first two, and the second and the dog tooth this is next unto them. But if the former teeth will not fall or be pulled out or if the latter issue before the first fall then the latter make their way through new sockets and turn in the upper jaw outward, in the lower jaw inward, so that there seemed to arise a new row of teeth, and in this, indeed, hath deceived many historian and anatomists also." He then speaks of supernumerary teeth and their effects.

Matthais Gottfried Purmann (1648-1711), a celebrated surgeon of Breslau, was the first to mention models in connection with dentistry; these, however,

were taken in wax. Outside of the material used, he fails to mention just how they were taken. Therefore, to Phillip Pfaff, dentist to Fredrick the Great, nearly a century later (1756), we are indebted for the use of the important material, Plaster of Paris. The impression being taken in two sections, one on the right and the other on the left, which were united and a plaster model obtained.

Nuck, Anton (1650-1692), a Dutch surgeon and anatomist, devoted great attention to dental surgery and protheses. His conception of irregularities of the teeth are the same as those of other authors of the day.

"As to the use of the file, far from rejecting it entirely as does Martin, he holds it necessary in many cases for planing down points and sharp edges of broken teeth, as well as for removing at least, in a measure, the inconven-

Fig. 14.—Pierre Dionis (1718).

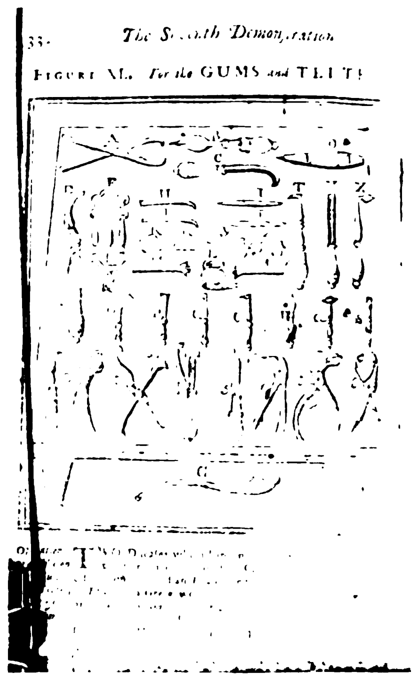


Fig. 15.—Instruments from Dionis' work.

ience and deformed appearance caused by irregular teeth. He says the file may be used without causing the slightest harm if one takes care not to approach the inner cavity of the tooth too nearly, and above all not to penetrate right to it, which would give rise to intolerable pain, such an accident he adds, may happen much more easily, when instead of using the file, whole pieces of teeth are removed with the excising forceps."[1]

Martin Benjamin (1679), "Apothecary to the Prince de Conde, was the author of a pamphlet[2] in which he gave a description of these organs and spoke briefly on their diseases. He shows himself decidedly opposed to the use of the file and to the application of false teeth, because according to him both of these things may be the cause of great harm. With regard to

1.—Nuck, A.: De ductu salivali novo, saliva, etc., 1690.
2.—Martin, B.: Dissertation s. les dents. Paris, 1679.

the file, he says that "nothing so easily tends to loosen the teeth as the use of this instrument, not to speak of various other conveniences, among which is the danger of opening the interior cavity of the tooth." This being the method then in vogue, his advice was a most timely one.

Pierre Dionis, a celebrated surgeon and anatomist of Paris, in his "*Anatomie de l'homme*" published in 1690, is perhaps the first to mention that there were those who practiced the science of dentistry alone, and gives the following advice:

"The teeth alone at present furnish the whole employment for several persons called operators for the teeth. It must be own'd that these Gentlemen, the sole object of whose labor are these parts only, may excell in their art, rather than the Chirurgeon, whose sicence is of infinite Extent; but yet he is not to neglect this part of Chirurgery in which he is to be acquainted that seven sorts of Operations are practis'd. The first is the opening or widening the Teeth when they are set too close together; the second to cleanse them when they are foul; the third, to hinder their rotting; the fourth, to stop the holes which grow in them; the fifth, is to file them when they are too long and jagged; the sixth, to pull them out when rotten, and the seventh to substitute artificial ones in the place of the natural."

"It is practic'd in three different cases, Viz: to separate them when they grow towards one another; to level them when some of them grow too long; to even and polish them when their points turn inwards, and grate against the Tongue, or grow jagged outwards and prick their Cheeks. On all these occasions we make use of the File V, provided with a handle that we may hold it the more steadily, it must be very fine so that it does not shake or loosen the Teeth, and tho' we don't make such hasty progress as we should with a coarse file, 'tis yet better to go on more slowly. The Operator is to sustain with one or two of his Fingers the Tooth on which he is working, to prevent its breaking or splintering whilst he is filing it. When the Operator is to separate the fore Teeth, he is to take care not to file one more than the other, that the spaces betwixt them may all be equal. 'Tis labor lost to file a too long tooth when that opposite it is wanting, at least unless we continue to do it from time to time, for 'twill continually shoot out beyond the rest, it being a certain truth, that the Teeth grow in order to repair their continual wasting by their mutual rubbing in Mastication; which Experience, proves in those who have had a tooth fallen out, for that against which it should rest, grows longer and shoots into the vacant space left by the lost Tooth. The Dentes Molares or Grinders have sometimes points as well as their Substance remains found and entire as when they come to putrefy, or when some part of them are splinter'd off. When these superfluous shootings out either prick the Cheeks, or grate the Tongue, they are to be filed off, in order to remove all sorts of roughness, and this is to be done gently, and with ordinary Care which is taken by those who follow this sort of practice."

In speaking of teeth growing outward; "They are to be drawn out, for the tooth which thus grows out of its rank very much incommodes the person to whom this misfortune happens, and occasions a deformity which shocks all who look on him. It doth not jet out very much beyond the other Teeth, the superfluous part may be fil'd or cut off with the Incisive Pincers,

but if the Table which ought to incline inwards is turned outwards, and the Tooth comes forwards, the Patient had better want a Tooth, than have one to disfigure him, wherefore 'tis to be drawn out with such instruments as the Operator shall think fit."

"When there grows a Supernumerary Tooth; for we very frequently find a Tooth jet outwards or inwards in the upper or under jaw, which is neither of the number of the rest of the Teeth, nor does it grow like them. Some people have several superfluous teeth, and others a double row, the Fortune tellers prognosticate a thousand Felicities to those to whom this happens, but for my part I take it to be an unhappiness to be often better stocked with Teeth than Victuals, to be pestered with too many Teeth, and be forced to suffer cruel pains to draw out this Natural Favor on which they are complimented."

"There are two questions which are canvassed with regard to the teeth, the first is, whether when we draw the milk teeth of children before they are inclined to fall of themselves they come again more beautiful and straight,

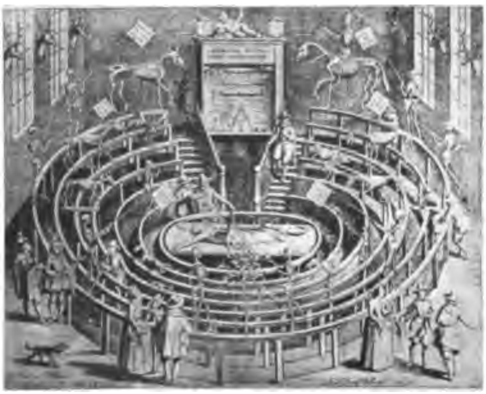


Fig. 16.—The Anatomical theatre in Leiden (1610).

and the other, whether a Tooth refixed in the Alveolus, after having been pull'd out may fasten and grow, as if it were not touched."

Expulsion of the First Teeth.

" 'Tis a mistake to believe, that the first teeth can give ill shape to the second, they are both of them form'd in little in the Alveoli, where they ossify. The first come out, after having served five or six years, are driven out by the latter which take their places and observe, that the first have only as it were a Table, because the others in their growth don't give time to the first to perfect themselves and to ossify at their roots, so that the old ones cannot spoil the shape of the new. I have found this by Experience in a young Girl, whose Mother caus'd all her sore Teeth besides one to be drawn, for the space of a Year before they ought to be expected to fall being full possess'd with an opinion that the succeeding growth would prove more perfect; but she was deceived, they proving worse than the former."

"Of the instruments us'd.

"The proper instruments for cleaning of the Teeth are contained in a case, because they are small, and being numerous they are screwed on the

same Handle (N), according as we have occasion to use them. There are several Figures, some are made like a shoeing horn (O), to go betwixt the Teeth, others like a Blade of a pair of Scissors (P), others like scrapers (QQQ), the third resembles a Graver, (R), and others a file (S), they are commonly of steel but those used to the King and the Princess are of Gold. And if there were yet a more precious Metal, we should employ it in their Service, because they reward us so magnificently." (See Fig. 15.)

Heister, Lorenz (1683-1758), of Frankfort-am-Main, one of the most celebrated surgeons of the eighteenth century, wrote a dissertation on Toothache, *De Dentium dolore*, Altdorf, 1711, treating besides very extensively of dental affections and their cure in a masterly work on surgery,[1] published for the first time in 1718, and which went through numerous editions in various languages.

Fig. 17.—Lorenz Heister (1683-1758).

Movable prosthetic pieces are probably mentioned for the first time by this author. Although he is very concise in his manner of speaking of artificial teeth (this indicating that dental prosthesis was considered outside of the sphere of action of the general surgeon), nevertheless we learn from him that partial sets of teeth made of ivory or hippopotamos tusks, and without special appliances for fixing them, were then in use, which, when applied in the void between the neighboring teeth were maintained in position simply by their form. The author advises keeping prosthetic pieces very clean, removing them every evening before going to bed and not putting them back in the mouth until they have been well cleaned.

On the other hand, the author expresses himself in favor of the incision of the gums, in cases of difficult dentition. According to him convulsions and other nervous symptoms which children are subject to during the period of dentition depends wholly on the hardness and strained conditions of the

1. A General System of Surgery. Lorenz Heister, Chapt. LXXXI, 1743.

gums. It is, therefore, natural that the symptoms should disappear when an incision of the gums reaching to the tooth that is coming through, has caused the tension to cease.

"Sometimes the teeth stand more out or in than they ought, and sometimes, the sharp points of a broken tooth stand out unequal which not only

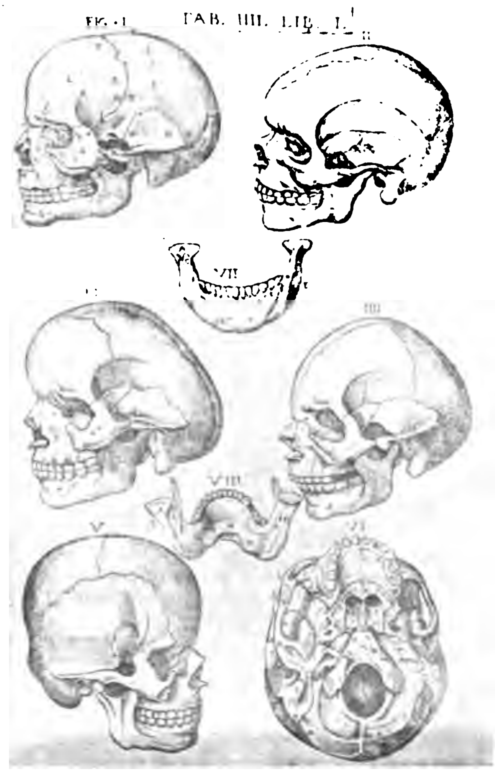


Fig. 18.—Skull.

impedes the mastication of food and formation of the voice, but frequently lacerates the tongue, lips and cheek; to remedy this disorder it will be necessary to file away the inequality with instruments or when that is impractical, to extract."

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EDITORIALS

Co-operation Between the Dentist and the Orthodontist.

If the dentists and orthodontists are to render the greatest possible service to the public, there must necessarily be co-operation between the two. The necessity for this co-operation is apparent to every one connected with these two professions, but in times past there has not been the close relation existing between the orthodontist and dentist that there should have been. There have been several reasons for the differences which have existed between the two groups, whose work is very closely related and whose success is often interdependent.

It is the dental practitioner who first observes cases of malocclusion. In fact, the general practitioner who has reached the point of being a "family dentist" will be in a position to first observe malocclusions that develop in young children. If he is desirous of doing the greatest service for patients who may require orthodontia treatment, he should have a consulting acquaintance with some competent orthodontist to whom he can refer his patients at the proper time, so that they may be treated with the least trouble to the patients and obtain the best results in the shortest time conditions will permit. There are, however, some dentists who refuse to follow this plan, and we have even known of men who, when they found malocclusion in the mouths of their patients, would not refer them to an orthodontist for several

reasons, the principal reason being that they take a purely mercenary view of the situation. Some have argued, "Why should I send this case to the orthodontist, or why should I send to some one else what I cannot do myself?" In other words, the dentist is not capable of correcting the malocclusion, yet he would allow the defect to remain rather than refer it to one who could probably treat it. This question of financial consideration has often been the bone of contention—whether orthodontists should pay commissions to general practitioners. As we do not desire to discuss this phase of the question at this time, we will simply state that the man whose perspective of malocclusions in cases of his patients is from the financial standpoint will not necessarily work for the best interests of his patients.

Other instances where co-operation between orthodontists and dentists is very beneficial to the patient are in those cases in which malocclusions are occurring or may be produced because of prolonged retention or early loss of the deciduous teeth. We have seen a great many cases of malocclusion produced by the early extraction of deciduous teeth, which could have been avoided if the dentist had consulted an orthodontist who was familiar with the manner in which malocclusions develop. We have also seen malocclusions grow from a minor defect to a serious condition simply because improper advice was given by the dentist, such advice often being for the patient to "wait awhile and the case will correct itself." If, therefore, an orthodontist were consulted in cases of malocclusion, in many cases in which his line of work qualifies him to understand the conditions better than are known to the general practitioner a greater amount of good would be accomplished for the patient, and, in fact, for humanity.

We must not blame the general practitioner or the dentist entirely for this lack of co-operation, for we are aware that there are many men practicing orthodontia who do not desire to be called into consultation with the general dentist unless there is a fee involved. Some orthodontists positively refuse to give advice in regard to the treatment of a case unless they can immediately obtain a fee. The orthodontist who takes this narrow view of life is certainly not disposed to benefit the community, or elevate his profession, and in a short time will find that a man with a broader view will gain his practice.

There is also an attitude assumed by orthodontists that they occupy a superior plane to that of the dentist—or, in other words, belong to a selected group—and do not care to communicate, advise, or consult with a dentist in regard to any case. We have also known of strained relations to occur between orthodontist and dentist after the dentist has referred a case to an orthodontist. The orthodontist often assumes entire charge of a patient, and does not to any extent consult the family dentist. We do not consider it advisable for the family dentist to attempt to advise the orthodontist how a malocclusion should be treated, but we feel that the orthodontist should show some consideration to the general practitioner in regard to fillings, bridge work, etc. We have known cases where general practitioners sent patients to a certain orthodontist, and this orthodontist referred the patients to another practitioner because the second practitioner was the orthodontist's personal friend. This is very unfortunate, for, if there is to be co-operation between the orthodontists and dentists, the patient referred to the ortho-

dontist should certainly be sent back to the man who referred him and not to someone else. We often find that an orthodontist objects to referring a patient back to the dentist on the grounds that the dentist in question does not do the character of dental work deemed necessary by the orthodontist after the malocclusion is treated. We are aware that many a case of malocclusion will be either a success or a failure, depending on the kind of dental work subsequently done, and there should be co-operation between the orthodontist and dentist in restorations. While the orthodontist is not supposed to know all about dental restoration, he should know something about the forces of occlusion and what must be done in order to treat the case successfully. The dentist who, therefore, fails to avail himself, in making artificial restoration and in building crowns, bridges, or inlays, of the knowledge which the orthodontist possesses regarding the laws of occlusion, will undoubtedly not render the greatest possible benefit to his patients. The dentist should be willing to observe the procedure by which the orthodontist desires restoration to be made so as to make the occlusion of the teeth self-retentive, and not advance the argument that because the man is an orthodontist he knows nothing about dentistry. The orthodontist is also in the wrong at times by failing to realize that the dentist is not familiar with cases of occlusion or the manner in which such casess should be treated. Then again, very often the family history of a case and idiosyncrasies of the patient, which are known to the dentist, would be of greater assistance to the orthodontist if he knew them.

In conclusion we will say that the most intimate the relation concerning the consultation between the general dental practitioner and the orthodontist, the better it will be for the dental profession and the general public.

Bands vs. Ligature.

THE use of the wire ligature as introduced by Dr. Angle several years ago is very well understood by all men who have devoted sufficient time to the practice of orthodontia. During the last few years, and especially the last few months, there has appeared in dental literature a number of articles in which it is claimed that a band as a means of attaching the malposed tooth to the regulating appliance is superior to the ligature. There are at least three different appliances recommended for orthodontia purposes whose employment requires the use of the band in preference to the ligature. In fact, these three appliances, as made by their inventors or designers, could not be used with the wire ligature. Those men who are using any of these three types of appliances have been very emphatic in condemning the wire ligature and attributing a great many faults to the ligature. We are willing to admit that the use of the wire ligature, as used by some men, has been productive of a great amount of injury. We are at the same time unable to realize how it would be possible for a band, if used in such a crude manner as the wire ligature has been employed by some, to cause less injury. We believe that the band, in the hands of those men who produce injury with the wire ligature, will cause even more harm than the ligature. Anyone who is familiar with dental anatomy, the proper shape of the tooth, and the histological

structure of the peridental membrane and gum tissue will agree that there is a small free space gingivally to the proximal contact point of the tooth, and occlusally to the proximal gum tissue, which will admit the passage of a wire ligature without injuring the surrounding tissue or separating the teeth. Some have claimed that the use of the wire has induced decay, but in our practice we have never seen the decay of a tooth caused by the use of a wire ligature. Such wire ligatures as have been used have possessed antiseptic properties far superior to anything that can be obtained in the use of bands, which are generally made out of noble metals. If the wire ligatures are too far gingivally or too far occlusally, it will produce harm in two ways. The ligature that is too far gingivally will necessarily sever the fibers of the peridental membrane, which holds the proximal gum tissue in apposition to the tooth and also holds the free margin of the gum in contact with the gingival ridge. A wire ligature too far occlusally will eventually separate the teeth, producing space between the approximal contact points. Either one of these two conditions is undesirable, and both can be avoided. We may say with equal force that with the use of bands either one of these conditions can be very readily produced, and, in fact, it is almost impossible not to produce one of them. We have for many years spoken of the disadvantages of the use of the bands, as they produce space between the teeth at the approximal contact points, and thereby destroy one of the forces of retention. With the use of bands on teeth we have often seen cases where, after the teeth were moved to the so-called proper position with the line of occlusion, spaces existed between all of those teeth, and these spaces have to be closed. It is during the closure of these spaces that a great many of them relapse, and the proximal contact points slip past each other, starting the teeth again toward malocclusion. We are aware that enthusiastic users of bands on all the malposed teeth claim the bands can be made so carefully, so accurately adjusted, and so fitted in the proximal spaces that they would fit in the proximal space gingivally to the proximal contact point, and not interfere with the free margin of the gum. Admitting this can be done, we must also admit that the band on the mesial and distal sides of the tooth must be so extremely narrow and thin that it will very easily be torn or displaced with a slight amount of force. We have seen a great number of appliances placed on teeth where the malposed tooth has been attached to the regulating appliance by means of a band, and the work has been very beautiful from a mechanical standpoint. So far as efficiency is concerned, there is no question that the appliances which depend on the use of the band will move the teeth, but we do not believe they will move them any better than the appliance which depends on the ligature.

So far as the esthetic phase and the welfare of the patient are concerned, bands placed on all the anterior teeth certainly present a display which is very displeasing. We have known of several strong objections being raised by patients because of the appearance of the appliance when bands are used on all the anterior teeth, and have known of patients who have even refused to have the malocclusion treated because of the appearance of such an appliance. While some men may be able to convince their patients that they should wear any kind of appliance, regardless of its appearance, there are a few patients who will not permit such a course of treatment. Taking all of

these points into consideration, we believe that, in the hands of a. skillful man, one who understands the shape of the tooth, the gum attachment, and the proper position for the wire ligature, and the application of the appliance so it will not move up and down to displace the ligature, such an appliance is much more esthetic than one in which the band is used. Admitting that the wire ligature has some disadvantages and that the use of the labial arch also presents a bad appearance, the only way to avoid this condition is to use the lingual arch, as has been suggested by Dr. Lourie and others the last few years. In regard to the use of the lingual arch as a means of avoiding the use of either bands or ligature, we will have more to say later.

The Teaching of Orthodontia in Dental Colleges.

WITH the change to a four-year course in dental schools it becomes necessary that the instruction be changed and that certain branches be added to the course, and that a greater length of time be devoted to other subjects. One of those subjects which has received a great deal of consideration is orthodontia, and it is well that such should be the case. It can be said with reason that no branch in the dental colleges has, as a whole, been more neglected than orthodontia, or has been so poorly taught. There is also justification in the statement that there is no other branch in dentistry which requires as much painstaking effort and no other branch which presents as many peculiar features as does orthodontia. It is fair to concede that at the present time the subject is not being taught exactly alike in any two schools in the country. This conclusion is reached because the men teaching orthodontia have, as a rule, been gathered from the ranks of the dental profession, and a great many of them have begun teaching orthodontia without any special training or instruction on the subject. In a great many cases certain men have been selected to fill the chair of orthodontia because no one else desired to take the position. This is not the case now to the same extent it was a few years ago, for at present probably fifty per cent of the schools have a chair on orthodontia filled by some man who has taken special instruction in the science, and who has devoted sufficient time studying that branch. But we can well remember when the chair of orthodontia was given to anyone who would accept it, and even at the present time, in some colleges, the board of control, or the "powers that be," do not attach enough importance to the subject of orthodontia to give it the dignity of a special chair and establish a professorship on that subject. There are a number of schools where orthodontia is still in the department of prosthetic dentistry or operative dentistry, and a few lectures are given by the man who teaches dentistry, or it is turned over to some assistant. Such a condition seems to be almost unbelievable when one considers that orthodontia is the only branch of dentistry which can be practiced as a separate profession without overlapping some phase of dentistry. It is the only branch of dentistry which is dignified by established schools giving special instruction in that particular line, and there are more men practicing orthodontia as a specialty than are practicing any other branch of dentistry as a specialty. This being true, it certainly seems that dental colleges should be awakened to the op-

portunity and the necessity of providing chairs of orthodontia filled by men qualified to teach the subject, and not be content to have orthodontia taught by anyone who will take the chair, regardless of that persons' training. Even in the majority of the schools the plan of instruction which has been followed in the years past has not been productive of any great amount of good.

A number of schools demand that each student shall treat a case of malocclusion during his junior or senior year, and in some schools during both years. Some schools also require that the student make a large number of appliances, going through a series of technical work in the manufacture of such appliances, which is supposed to fit him for the practice of orthodontia. It is just as absurd to imagine that technical instruction in appliance making—the cutting of threads and screws, the making of clamp bands, instruction in making arches by cutting the threads and making the nuts—will fit a man for the practice of orthodontia as it would be to imagine that instruction in the making of the plugger points would enable a student to insert a gold filling, or that the making of an excavator would give him the ability to prepare a cavity. The practice of orthodontia and the construction of appliances are two different matters. Of course, it is necessary that an orthodontist know something about the construction of appliances, but it certainly does not qualify him to practice the science by being compelled to go through a long series of technical appliance making, when the appliance can be bought from the appliance maker much more cheaply and much more accurately constructed than he, making only a few, can construct them. Also, the plan of having the dental student treat a case of malocclusion during his college years is very defective, because it has been proven that orthodontia cannot be successfully practiced in connection with general dentistry, and it is equally true that orthodontia cases cannot be successfully treated in connection with other clinical work. While every dental student should study orthodontia in dental colleges, to our mind it is just as absurd to expect every student to treat a case of malocclusion as it is to expect every medical student who studies surgery to perform a major surgical operation while he is a medical student. The performance of major surgical operations by medical students would not, of course, be permitted, but nevertheless some dental colleges expect students to perform operations equally as difficult, from a dental standpoint, during their student career. The result of having the dental students treat these clinical cases during their college years is, generally, to discourage the dental students from engaging in the practice of orthodontia, because very few students are able to complete their case during the year, and in a great many instances one student "inherits" a case from the class before him. These cases are dragged along from one school year to another, very little is accomplished in the way of successful treatment, the patient becomes discouraged, the student becomes discouraged, and orthodontia, as a profession, receives a bad name.

It is our belief, based on several years' observation, that the best success can be obained in the teaching of orthodontia by having that branch supervised by some one who has taken special work on the subject, who is making orthodontia his life work, and who is devoting his entire time to the practice of the science. It necessarily follows that the man who teaches orthodontia

in the dental colleges should be one who has had some training along that line. The details which should be taught include the basic subjects, such as the occlusion of the teeth, the forces of occlusion, classification of malocclusion, principles of malocclusion, and the possibilities of treatment. If a technical course is pursued, it should be a course which would include only such details as the practitioner of orthodontia is called on to perform in his line of work. That would include the taking of impressions and the making of the models, and the making of a few plain bands. The taking of an orthodontic impression certainly would be a great training in any branch of dentistry.

It is necessary that the dental student should know the possibilities of orthodontia—know something about the appliances and the construction and application of appliances—but we believe he can learn that best by seeing those appliances constructed and applied by some one who does it skillfully. He will also have a better knowledge of the practical side of orthodontia, and the possibilities of treatment by seeing cases treated by some one who is skilled in their treatment. Malocclusion should be treated in dental colleges, but the orthodontic clinic should be conducted like the nose and throat clinic, or any other clinics in the medical schools. The professor or assistant instructor in that branch should treat cases himself. A room should be provided in the dental college for orthodontic work, the class should be divided into sections, probably of ten or twelve, and each section should be compelled to attend the orthodontic clinic at a certain time and for a definite period. If the classes are too large, so that one man could not give them proper instruction, there should be a sufficient number of assistant professors to have charge of a certain number of cases, in order that all of the class could see practical treatment of malocclusions demonstrated by some one who is experienced in that subject. The members of each class would then know the possibilities of orthodontic treatment, they would understand the causes and results, and the patient would receive corresponding benefit, which in not always the case where the malocclusion is treated by dental students. We are aware that this plan of instruction would mean the addition of a certain amount of space and equipment to conduct this clinic, but the orthodontic clinic should be conducted in a separate room, the same as the oral surgical clinic is conducted in some dental colleges. When this plan is followed, the dental student will have as much respect for orthodontia as the medical student has for surgery, and the greatest advances will be made in the treatment of malocclusions. A practical knowledge of the subject will then be acquired, which has been the exception rather than the rule.

The Esthetic Side of Orthodontia.

TO those who are familiar with the benefits of orthodontia it is known that the correction of malocclusion of the teeth will eliminate many evils, and that malocclusion produces a great many ills. The teeth, in normal occlusion, perform a great many functions, and the principal reason for correcting malocclusions is to place the teeth in their proper positions, so they can perform the functions of mastication. We find, however, the knowledge

of the public in regard to correction of malocclusion is often limited to the effects of malocclusion on the face. The majority of the people who seek the services of the orthodontist do so in order that the facial appearance may be improved. There probably is nothing that produces as much facial deformity as malocclusion, and it is also probable that the effects of malocclusion on the face are very poorly understood. Of course, such extreme conditions as protrusion of the upper incisors, overdevelopment of the mandibles, and underdevelopment of the mandibles, and extreme facial deformities found in mesioclusion and distoclusion are recognized by the public. Even then, however, a great many people fail to realize that the principal deformity, or cause of the deformity, lies in the malocclusion of the teeth. Dr. Henry Clay Ferris, of New York, has written several papers during the last few years dealing with the effect of malocclusion of the teeth on the beauty of the face, especially on the beauty of the face of a child. It necessarily follows, that if malocclusion produces deformity of the face of a child, there will likewise be a deformity of the face of the adult. Dr. Ferris' idea has been, however, to appeal to the parents, and have them realize that something can be done to correct the facial deformity of their children, and to have them realize also that the dental apparatus, with the surrounding muscular structures, was the principal thing to consider in the beauty of deformity of children. In the November issue of the *Oral Hygiene* magazine is an article by Lawrence G. Singleton, of Pittsburgh, entitled, "Facing Our Patients." He makes a startling statement, although true, in the following words:

"Down the avenue they are selling false faces. How many people need to buy them? There are more real live false faces on the street than artificial ones in the store. How does anybody know? Look at their teeth.

"Does not the contour of the face depend on the bony frame work, which gives support, and does not this underlying structure consist of the teeth and those parts necessary for their maintenance?

"The teeth are a part of the scheme for the individual, but for a full realization of its inheritance they must assume their typical and characteristic arch form and relations. Do you think you would be overjoyed if you knew that your child was wearing a face that did not belong to him? People are not born with false faces, but get them after they grow up. And growing up with a motley array of human teeth in the mouth puts a cartoon on your shoulders instead of your own natural face."

These quotations, taken from Dr. Singleton's article state the truth in a way that probably has never been stated before. He also impresses us with the fact that we, as orthodontists, to a certain extent have to deal with the making of the human face. It, therefore, is necessary that we become familiar with the proper proportions of the human face in such a manner that we can recognize what is best for a particular type. Dr. Angle several years ago announced the doctrine that the best balanced and best proportioned face was found where all the teeth were in normal occlusion, and it is our belief that doctrine has never been disproven. We are, however, confronted very often with conditions of malocclusion in which there is a facial deformity, and we must know enough about the development of the face and about the beauty of the face to be able to advise our patients as to what the ultimate result will be if the teeth are placed in proper occlusion, and

what the ultimate result would be if not properly treated. We very often find that certain types of malocclusion, which do not seem defective to the parent, may be producing facial deformities which are very noticeable to one who is versed in the proper development and balance of the face. We often find a type of malocclusion in which the teeth are in very good alignment, so far as the proximal position of the teeth are concerned in each arch, but there is an infraversion of the molars, permitting a great overbight in the region of the incisors, which not only produces a very unpleasing facial expression, but has a tendency to cause a great many other ills. The extraction of any of the teeth even the posterior teeth, is almost sure to produce a facial deformity, which can be easily recognized by one who is familiar with such conditions. When we remember that the teeth are supported by the maxilla and the mandible, which two bones make up the greater portion of the face, and which bones give attachment to all the muscles of expression, it is apparent that, if the maxilla and mandible are not properly developed, it will result in facial deformity. It then follows that the underdevelopment of these two bones is sure to produce some facial deformity, and that orthodontic treatment is the only procedure that will correct it. Therefore, while the esthetic phase of orthodontia is by no means the most important, it is that phase which probably appeals strongest to the majority of parents, and it becomes necessary for those practicing the science to know enough about the perfection of the face to be able to advise the patient intelligently.

Announcement.

THE editors are pleased to announce that they have procured for publication in the Journal, beginning with March, 1916, a comprehensive series of articles by Dr. B. E. Lischer, Professor of Orthodontics in Washington University, St. Louis, entitled: "FACE FACTS—A Clinical Study of Dento-facial Deformities."

The following synopsis will give some idea of the completeness and great value of these articles, not only to those practicing orthodontia, but to the dental profession as a whole:

I. Normal Variations of the Head-form.
II. Normal Variations of Dentition.
III. Normal Facial Types.
IV. Abnormal Facial Types.
V. Abnormal Dentition.
VI. Orthodontic Methods of Diagnosis.
VII. Facial Types, Pathology and Prognosis of Neutroclusion.
VIII. Facial Types, Pathology and Prognosis of Distoclusion.
IX. Facial Types, Pathology and Prognosis of Masioclusion.
X. Extreme Maxillary Malformations.
XI. Malpositions of the Mandible.

This series of papers will form an important contribution to *oral pathology*, and will be richly illustrated with over one hundred fine illustrations, most of which are new and prepared especially for this purpose.

"Apropos."

WHEN one recalls the advance made by the science to which *The International Journal of Orthodontia* exclusively devotes its pages, and the utter chaos out of which this science has been evolved, we realize that it has established itself as a highly specialized art, to be compared favorably with many of the departments of modern medicine. When practiced intelligently and efficiently, it is the most interesting and fascinating branch of dentistry, and is rapidly acquiring a relation to dentistry that surgery maintains to medicine.

Not very long since the mere straightening of crooked teeth was generally known throughout the dental profession as "regulating," which latter term, we are glad to see, is rapidly passing, if for no other reason than that in our mind somehow it is difficult to divorce this term "regulating" from an atmosphere of watches or torpid livers.

Orthodontia enjoys its present state as a result mostly of the efforts of Edward H. Angle and others, who untiring in their efforts, not only recognized the great fundamental principles which underlie the science, but also established beyond a doubt that orthodontia could be mastered or intelligently practiced only by the most thorough application and the closest attention to every detail, from the taking of the impression in a thoroughly scientific manner to the ultimate fixing and maintaining in position of normal occlusion. Anything short of this amounted to only a compromise, and should be resorted to only in the most unusual circumstances. These men devoted the best years of their lives teaching the dental profession these basic principles, and the monument of their efforts is the high state of efficiency which the science of orthodontia has attained. It has also been demonstrated that the operator who has not grasped the great principles of application and thoroughness for which the pioneers have stood is still as helpless in the correction of malocclusion as he was before they blazed the trail.

The above being a true statement of conditions, and a matter of history to those familiar with the orthodontic situation, does it not behoove each orthodontist, as well as every dentist who has given special study to this work, to maintain orthodontia on the high plane which its earnest workers have established for it, and to impress on every new practitioner entering the field of orthodontia the necessity of devoting sufficient time and study to the work to enable him to advance beyond the experimental stage. The necessity of the most thorough equipment should be emphatically pointed out. It must be borne in mind that our dental schools do not provide a course in orthodontia which enables their graduates to intelligently treat malocclusion.

Let orthodontists collectively and individually insist on better training for men who attempt to treat malocclusion, and the wire entanglements, along with the suffering of humanity, as a result of imperfect orthodontic treatment, will become antique relics, but for which at present the science of orthodontia unfortunately must still assume responsibility in the eyes of the laymen.

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ORIGINAL ARTICLES

STUDENTS AS ORTHODONTISTS

BY ADELBERT FERNALD, D.M.D.
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THE question is often asked, "Is it practical for dental students to do orthodontia?" In answering this question there are several sides to be considered. First, the ability of the student, and second, the student's education and practical training along those lines related to orthodontia. To give a student a case of malocclusion to treat without first having that student thoroughly trained along orthodontic lines is malpractice, but to give him a training in an efficient course of lectures and practical work, covering a period of not less than two years of nine months each, along with the outside reading of text books, I think it is then perfectly safe in allowing him to take charge of two cases of malocclusion, the student doing all the work, making all the necessary appliances, but being directed by an instructor in charge. During the session of 1914 the students at the Harvard Dental School successfully treated 109 cases of malocclusion, made 228 appliances, occluded 308 models of the regularity; and for practice work, made 64 models and 108 regulating appliances.

I will not take time to show the many common cases which were successfully treated by the students, but will give the history of a few special cases, which I think will be of interest. The cases illustrated in this article do not represent our whole clinic, as they have been selected only from one-fourth of the clinic of which I have charge.

Case I.—The first case (Fig. 1) is a Class II, Division 2 case of a little girl 11 years of age. The case was treated in 1913. Clamp bands were placed on the first permanent molars, the expansion arch was adjusted with the intermaxillary hooks. The superior arch was expanded. Plain bands were placed on the centrals, a spur at the mesio-linguo-gingival angle for the rotation of the centrals. Clamp bands were placed on the first permanent molars below, and the expansion arch adjusted. The lower incisors overlap each other, which does not show in the photograph, and they were also expanded and carried forward to make them occupy their

proper position in the line of occlusion. After the upper arch was expanded, the intermaxillary anchorage was adjusted to bring the lower arch forward and establish a normal mesio-distal relation of the arches. In treating Class II, Div. 2 cases, a better result is obtained by first expanding the arches to their proper size, and then employing intermaxillary rubbers to bring the lower arch forward, thereby avoiding an unnecessary strain upon the upper molars, which would result if they were used as anchor teeth, both in expanding the upper arch in the incisor region and as an intermaxillary anchorage to bring the lower arch forward. By first expanding the upper arch, before putting on the intermaxillary rubbers, we have an opportunity of conserving our molar anchorage, and by having all the upper teeth ligated to the upper alignment wire after they have been expanded, we greatly increase our anchorage and are thereby able to bring the lower teeth forward to their proper position. The upper teeth were retained by placing plain bands upon the superior molars and cuspids, and an 18-gauge wire was soldered to the lingual side of all four bands. An 18-gauge wire was soldered

Fig. 1.

Fig. 2.

to the labial surface of the cuspid bands, running across the labial surface of the centrals, terminating in a hook at each end for an intermaxillary elastic. The use of a wire labial and lingual to the central incisors prevented them from rotating, eliminating the use of bands upon those teeth during the process of retention. The inferior first molars and canines were also banded and an 18-gauge wire soldered to the lingual surface of the bands. A hook was soldered to the mesio-buccal angle of the lower first molar band, and intermaxillary rubbers were adjusted to the hook on the lower molar band and the hook on the upper canine band, and worn for some time. The patient was eleven years old, and today the occlusion and the facial lines are normal. The parents and the little patient are very grateful for the improvement which the student made. The finished result is shown on the right-hand side of Fig. 2.

Case 2.—The second case is a Class II, mutilated condition. The girl is twenty-four years of age, and the superior left lateral has been extracted. All four of the first permanent molars were badly broken down and improp-

Fig. 3.

erly filled. The cutting edges of the upper and lower incisors were full of pits and grooves, due to the imperfect health of the patient. The models of the case before treatment are shown in the left view of Fig. 2, and the cross mark on the upper model should be in the region of the lateral incisors, as that tooth is missing, instead of in the canine region. The occlusal view of the case, before treatment, is shown on the left of Fig. 3, and it will be seen that the arch is very much contracted, which resulted in an underdevelopment of the nasal cavity, interfering with the patient's breathing and general health. The patient, at the time treatment was begun, was not in the best of health, the mastication of her food was imperfect, and she probably would have suffered more or less during her entire life because of her inability to masticate properly and her inability to breathe through her nose, owing to the contraction of the upper arch and the hard palate, and the underdeveloped nasal cavity. This type of patient is always subject more or less to chronic colds, since any congestion of the mucous membrane in the nasal tract interferes with breathing a great deal more than it does in an individual who has a normal occlusion and a normal nasal passage. Clamp bands and expansion

arches were placed on the upper and lower first molars with intermaxillary hooks in the region between the canine and lateral. The upper arch was so adjusted that there was expansion in the canine region, and the arch rested

Fig. 4.

Fig. 5.

Fig. 6.

against the central incisors. By expanding the canines, laterals, and premolars, the dental arch was widened, and the nasal space was increased. The right-hand model in Fig. 3 shows very nicely the change that was brought about. The upper arch in the premolar region was expanded

nearly three-quarters of an inch. The retention of the case was accomplished by making bands for the canines and molars of the upper arch. A wire was soldered on the labial surface of the canine band, extending from one band to the other, the distal end of which was bent into a hook to receive the intermaxillary rubber. Bands were made on the lower molars and canines and a lingual wire was soldered to all four bands. A hook was attached to the mesio-buccal corner of the lower first molars to engage the intermaxillary rubber which extended to the hook on the upper canine, which was used as intermaxillary retention for a short time, and then discontinued. As a result of the treatment of malocclusion, the patient's health was very much improved, and she can now breathe through her nose and masticate her food much better. The case was finished in 1914.

Case 3.—The third case is a mutilated case of Class III, in a girl 14 years of age. The first permanent molars were badly decayed, and the cutting edges of the central incisors were missing, owing to the atrophy of the enamel organs. The left-hand model in Fig. 4 shows the front view of the

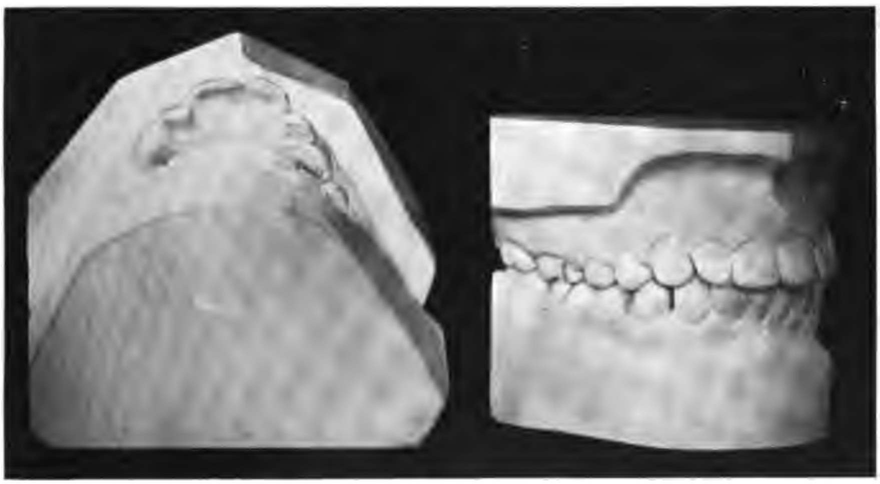

Fig. 7.

models before treatment, and it will be seen that the only teeth in occlusion are the second permanent molars. Fig. 5 shows a photograph of the patient's face, and the position of the anterior teeth can be seen; the patient was unable to close the anterior teeth, the second molars being the only teeth in occlusion. Owing to the fact that the patient could not close the teeth, the speech was very much interfered with, and proper mastication was impossible. The infraocclusion in the region of the central incisors was little more than half an inch. The treatment of the case was begun in 1913, and at the present writing is not quite completed. The superior first molars were banded with clamp bands; plain bands were placed on the six anterior teeth, with hooks on the labial surface for the alignment wire to rest in. The lower first molars and six anterior teeth were also banded, hooks were placed on the labial surface of the lower incisors for the lower alignment wire. Intermaxillary hooks were placed on the lower alignment wire in the cuspid region. Intermaxillay rubbers were adjusted and worn until the molars and bicuspids

were nearly in normal occlusion before intermaxillary anchorage was applied up and down to close the infraocclusion in the region of the canines. These intermaxillary anchorages, or rubbers, in the region of the canine to reduce the infraocclusion, were attached from the intermaxillary hook on the lower arch to a hook placed on the upper arch. All the anterior teeth being banded above and below, the teeth were ligated to the arch, so there could be no slipping, and thus the infraocclusion was reduced gradually without producing any harm to the pulps of the teeth. Fig. 6 shows the great improvement accomplished in the facial outline, while the model on the right in Fig. 4 shows the improved condition of the teeth and the amount of lengthening brought about in the region of the incisors. It will be observed that the lengthening, or the occlusion of the incisors, has been accomplished without increasing the length of the crown; in other words, the gum and the alveolar process have moved with the teeth. Just exactly where the greatest amount of movement has occurred I am not prepared to state. The case is still under treatment. The patient attended school while the treatment was in progress, and the general health has been good. The photograph from which Fig. 6 was made was taken October 20, 1915. It is our intention to crown the upper central incisors later.

Fig. 8.

Case 4.—This patient was a girl 16 years of age with a Class II case of malocclusion, with protruding upper incisors, excessive overbite, narrow upper arch, underdeveloped mandible, which can be seen on the left of Fig.

7. The occlusion of the lower incisors against the upper gum can also be seen. In this class of cases, it is not only necessary to move the lower arch forward, but it is also necessary to elongate the molars so as to overcome the supraocclusion or excessive overbite in the region of the incisors. This excessive overbite is probably the result of an infraocclusion of the lower molars, rather than supraocclusion of the lower incisors. Bands were placed on the upper first molars, and the alignment arch was adjusted so that it rested against the labial surface of the central incisors and stood buccally to the canines. Intermaxillary hooks were placed on the upper alignment wire in the region between the canine and lateral incisors, and the incisors and premolars were expanded by being ligated to the alignment wire. Bands were placed on the lower molars and premolars, and the alignment wire ligated to the lower teeth. By the use of the intermaxillary rubbers the upper incisors were retruded, and the forward pull of the lower molars moved the lower teeth forward, and when the lower incisors came in contact with the upper teeth the continued pull of the intermaxillary rubbers elongated the

Fig. 9.

lower molars as is shown by the model on the right-hand side of Fig. 7. Retention was accomplished by using the same sort of appliance as described in the first case. The facial lines of the patient were very much improved and the patient was very grateful.

Case 5.—This patient (Class III), a boy 14 years of age, had all the teeth present and in good condition. Fig. 8 shows the facial profile of the patient, and the case is very interesting and remarkable because of the rapidity with which it was corrected. The first permanent molars were banded and the alignment wire adjusted, intermaxillary anchorage being used. The models on the left in Fig. 9 show the case before treatment, with all the upper incisors in lingual occlusion to the lowers. In five months all of the appliances were removed, as normal occlusion had been established. The patient was kept under observation for four months, with appointments every few days, and as the occlusion remained normal, no retaining appliances were applied. The boy attended high school while his teeth were being treated, and although results were obtained so quickly, no harm was done. He complained of his teeth being sore only during the time the

superior incisors occluded on the cutting edge of the inferior incisors. Although his teeth were moved more rapidly than would be advisable for the majority of cases, none of the pulps were destroyed as the result of

Fig. 10.

Fig. 11.

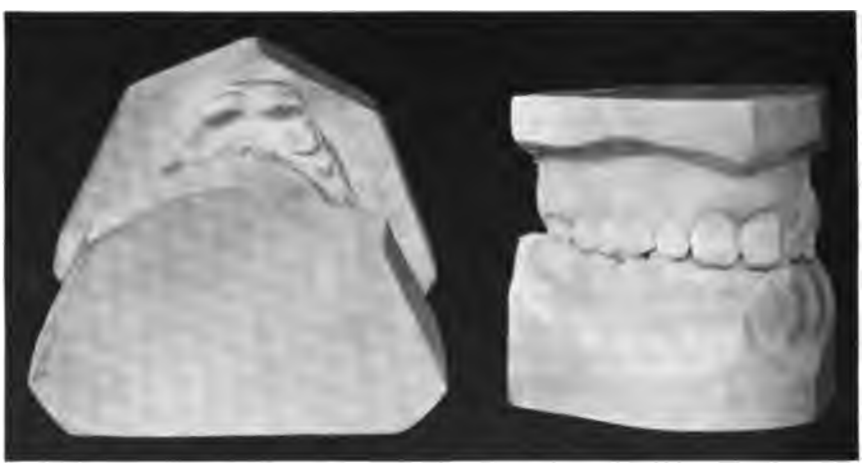

Fig. 12.

that movement. We would not advise as rapid a movement as occurred in this case, and do not encourage students to move teeth rapidly, believing that a slow movement is much better for all cases. The result of the treatment is shown on the right-hand model of Fig. 9, while the improved facial

profile of the patient is shown in Fig. 10. By treating this case at the time we did, the great facial deformity was overcome and the malocclusion corrected, which in all probability would have been progressive and become much more extreme as the patient became older.

Case 6.—Fig. 11 is a photograph of a girl 14 years of age, with a case of Class II. The upper first permanent molars had been extracted. Treatment was begun in 1913 and finished in 1914. The patient had adenoids and was a mouth breather; the adenoids were removed before the treatment was begun. The models on the left of Fig. 12 show the occlusion of the teeth before treatment. Clamp bands were adjusted and cemented to the upper and lower permanent molars, and the upper alignment wire was adjusted so

Fig. 13.

Fig. 14.

it rested against the upper central incisors and stood away from the premolars and canines slightly in order that those teeth might be expanded. The nuts on the upper alignment wire were kept away from the tubes so that during the process of expansion of the premolars and canines the upper incisors could be carried distally. The lower alignment wire was adjusted so as to produce the necessary expansion with the teeth ligated to the lower arch. Intermaxillary anchorage was used, which retracted the upper incisors as the canines and premolars were expanded. When the upper incisors were retracted to a sufficient degree to produce a normal-shaped upper arch, the nuts on the upper alignment wire were allowed to rest against the tubes on the molar bands and pitting all of the upper teeth against all of the lower teeth, thereby bringing the lower arch forward without displacing the upper per-

manent molars. The result of the treatment is shown in the left-hand model of Fig. 12. As a result of the treatment, the occlusion was made more efficient and the health of the patient has been much improved since the work was done. The retention of the case was the same as described in Case 4. Fig. 13 shows the improvement of the facial profile, and it will be seen that

Fig. 15.

Fig. 16.

the mandible is very much developed, there is an increase in width in the region of the nose, and the entire facial outline is very much improved. There is still a slight stretched expression about the lips, which is very often the result in these cases, as the upper lip, having been underdeveloped and unused for so many years, has not yet fully assumed its normal function. Fig. 14

not only shows more or less of the profile of the patient, the well development of the mental eminence of the chin, and the proper shape of the mandible, but it also shows the occlusion of the molars when the teeth are closed. The result obtained in this case is very gratifying and we believe it is far superior to anything that could be obtained by any other line of treatment. By the method of bringing the lower arch forward the entire distance and not moving the upper molars distally, we produce a better development in the mandible and a better balance in the face than is produced by that plan of treatment where there is a harmonious condition established between the molars rather than by establishing the absolute normal position of the lower teeth. This case also shows that even at 14 years of age, if properly treated, the mandible will still develop to a great degree,—in fact, to its normal size, as we believe it did in this case.

Fig. 17.

Case 7.—This patient, a girl 15 years of age, possessed a Class III case of malocclusion; infraocclusion of the incisors fully one-half an inch. The position of the teeth and the molars when closed is shown in Fig. 15, and the models of the case are seen on the left of Fig. 16, which illustrates the mesiodistal relation of the arches at the time treatment was begun. Clamp bands were placed upon the upper and lower first molars, adjusted and cemented. Plain bands were placed upon the upper incisors with spurs on the labial surface to support the alignment wire from slipping occlusally. An intermaxillary hook was placed in the region of the lower canines to use as intermaxillary anchorage in moving the lower arch distally. An intermaxillary hook was also placed in the region of the upper canines to receive an intermaxillary rubber extending from the lower canine to the upper canine to overcome the infraocclusion. By the use of the intermaxillary rubbers, as described in the third case, the teeth were moved to such a position as shown on

the right-hand model in Fig. 16. This change was produced in 15 months; the change in the patient's profile as the result of the treatment, is shown in Fig. 17. This is another case that would have been progressive if allowed to continue, and one when treated, as mentioned above, has produced a facial result which is a great improvement over what we formerly had, and, it is needless to say, was greatly appreciated by the patient. The improved masticating apparatus, as seen by comparing the models in Fig. 16, can not help but be a great benefit to the patient and have a great effect upon the general health of the individual.

Case 8.—The models shown in Fig. 18 on the left-hand side, are those of a girl 16 years of age who had a Class II case of malocclusion. The upper incisors were bunched, which made it necesssary to adjust bands to those teeth with a spur on the disto-lingual angle of the band to engage a wire

Fig. 18.

ligature so as to rotate the teeth. The regular clamp bands and alignment wire was used on the upper and lower molars, with intermaxillary hooks attached to the region of the upper canines for intermaxillary anchorage to be used in moving the lower arch forward. After the upper arch was expanded and the incisors placed in their proper positions, intermaxillary rubbers were used to correct the mesio-distal relation of the arches. The retention used in this case was the same as employed in the first case, and the finished result is shown in the right-hand model of Fig. 18.

We believe the results shown in these cases are very gratifying, and demonstrates that if the proper plan is pursued it is possible for students to treat malocclusion in dental colleges. When a patient has been assigned to a student to have his teeth corrected, the mouth is first placed in a healthy condition by doing all the necessary filling and cleaning. The student is given a step card on which the record of the case is kept. When he takes

the impression, if it is satisfactory the instructor in charge marks his card. The same procedure is followed when bands and models are made, and before the bands are cemented in place. By this method, from beginning to end, every step is inspected and marked before the student can go ahead. This gives us definite results and definite records of what is being done. If any one step is wrong, the student makes the necessary corrections. The patient, student, and instructor are marked present on the average of practically every hour, so that a record is kept of all interested in the case. The instructor being present with the patient, gives the student instruction in every case; the student does all the work. By this method, we have found that it is practical for students to do orthodontia. When the boys graduate, and have treated successfully cases like the above, and have seen over 100 other cases, they will have no trouble when they enter upon practice in treating the simpler irregularities. Even the poorest will at least recognize the abnormal cases, and can advise the patient to go to a specialist if he does not care to correct the case himself. Many students may not care to do orthodontia after they graduate, but their dental education would not be complete if they had not, while at school, received the course of training in this very important subject—orthodontia.

JURISPRUDENCE.

The Introduction of Communistic Theories of Government into our Individualistic System.

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THERE are two distinct theories of society or government which, for the want of better terms, may be designated as (a) the communistic, and (b) the individualistic.

In the communistic theory the community or State is the unit and in it the right of all its members are centered; in fact the individual derives his rights from the aggregation. He has no personal rights except those which are conferred upon him by concession of the community and no political rights except such as are conceded by the body politic. No one comes into the world and finds himself in a state of nature. Society in some form of development is already there and he finds himself immediately subject to its regulations. As the community existed before he came and will continue to exist in the infinite æons of time after he has gone, it cannot necessarily have been dependent upon him for its existence or its power. In fact the little part he plays upon the stage of existence is but a mere incident in the perpetual life of the community into which he happens to be cast. The duty, if any, of the community towards him depends entirely upon the effect of his presence upon that community. If only a burden it may be too great

to bear and the Tarpeian rock ends the incident. He is entitled to nothing as a matter of right, not even to existence, if it is to be at the expense of the lives of others, and all the recognition he gets is merely by way of voluntary gift from the community of which he is permitted to form a part.

In the individualistic theory of government, the individual is considered the unit of right and power. According to this theory you can no more construct society without regard to the rights of man than you can construct a building without reference to the properties of the materials used. Bricks constructed into an edifice have merely changed their relation to each other without losing any of their original properties. They still have extension, form, weight, color, impenetrability; so the collection of human beings into families or communities, while changing their relation to each other, does not change the inherent rights of the component members. As the edifice derives its form, dimensions, appearance and characteristics from the indestructible properties of its component parts, so the social organism depends for its existence, its vitality, its rights, upon the inalienable, indestructible and ever-assertive rights of the individual. There are many obligations and duties pertaining to the person which the experience of the ages teaches should be left to the discretion and absolute will of the person and it is only when their exercise is fraught with weal or woe to society that the latter is justified in exercising a curb upon the former. The *man* is more important than the *citizen.* He is not a mere inanimate object placed by fate in the social organism without ambition or power to change his relation to his surroundings, but a living unit of dynamics in thought and force which has the inherent power and right to create and control its relation to the community life into which it is projected. To him citizenship is an inherent right with which he is endowed by his Creator,—not a gift bestowed by the State.

The one theory considers the completed structure; the other the individual parts. According to one theory man is predestined to a place in a social organism with little right or power to shape or determine the part he will play in its life and activities; according to the other theory he is endowed by his Creator with the inalienable rights of life, liberty and the pursuit of happiness, and the state must demonstrate its right to control his conduct by its ability to control, to his advantage and welfare, the general conduct of the community. If he surrenders any freedom of action it is to receive a *quid pro quo* in increased security and opportunities for the enjoyment and use of his faculties. These are central ideas around which the respective civilizations develop and through which they find expression. They have a remote parallel but not a synonym in *local* and *centralized* government. It is not our intention to make any extensive comparison or contrast of the relative merits of the two theories nor of the governments which are evolved through them. Suffice it to say that both have their merits and both represent influences to be avoided. There are dangers in both directions. The extreme assertion of the rights of the individual would mean anarchy and chaos, with selfishness as the only incentive to action; the extreme type of the communistic idea would be a despotism with slaves as subjects without thought of individuality or personal initiative. The highest expression of civilization must necessarily combine features of both theories.

Men think; communities feel. Men are active, communities passive.

Genius is an individual trait. Mind may work in harmony with other minds but they have no interdependence; they may co-operate but they do not coalesce; they may strive for the same end but their energies are not cumulative. A million pairs of eyes may be directed to the study of the splendors of the starry heavens, but they do not represent accumulated power, as each pair is directed and controlled by only one mind. Mental co-operation is largely successive,—not contemporary. An army represents the aggregate physical force of all its members but its mental force is expressed and circumscribed by the one mind which controls its movements. The aggregation, army or community, may be a unit of might but it is not a cumulative dynamic unit of thought. It cannot have a force superior to the highest intelligence among its individual membership, and may in fact be controlled by its lowest intelligence. You cannot unify and cumulate thought as a dynamic force. With all your combinations each mind remains a unit. In all things where mentality is the controlling factor,—in the realm of thought—the individual must be the unit, and in these fields of endeavor he must be recognized as superior to the community. All progress in the world, all achievements in the new fields of thought and action have come from individual initiative and endeavor, but on the other hand the conservation of what has already been attained, the application of the greatest effort to a definite purpose, the realization of the greatest good to the greatest number have been effected only by combination. That individualism is wasteful of the world's energies and resources cannot be gainsaid, but it must also be admitted that communism too may be misdirected and lack definite aim, while whatever initiative it may have it must necessarily derive by and through its component members.

To understand and appreciate the effect of these theories upon the development of social, political, commercial and industrial institutions, we must look to the controlling motives of human actions. Individual assertiveness in community life is only a manifestation of the instinct of self-preservation. The conscious ego attempts to influence the conditions affecting it in its surroundings in a manner most conducive to its welfare and resists any influence which appears to be inimical to its well-being. All other considerations are subordinate to the duty to maintain life with liberty and its accompanying comforts. But this same law of existence applies to community life; therefore, the community also must resist extinction—yea even any encroachment which seriously threatens its welfare or the welfare of its members. Here is where the conflict begins. The wisdom of the ages has been exhausted in the effort to harmonize these contending forces. On this field have been waged the great battles of the law whose supremacy has been won over individual selfishness, ignorance and foreboding. *Thou shalt not* runs, to the individual, the order of the State and the mandate of the Most High. At every point the individual is touched by the spirit of that super-individual the community life. However, on the other hand this pertinacity of human nature has prevented any permanent encroachment upon the rights of the individual which was not clearly demonstrated to be essential to the public safety, but since the whole is greater than any of its parts, the rights of the community must prevail over those of the individual whenever and wherever an irreconcilable conflict arises between them.

In any form of social organization the individual must surrender some rights and submit to some degree of control over his conduct (with a like surrender and submission by others) for the benefit of the entire community. Revenge for a wrong, either real or fancied, is sweet to the avenger, but it usually has a recoil which, in the end, may take all its sweetness away. Sometimes the injured party may be physically inferior to the wrong-doer and unable personally and alone to redress the injury. Here, as in many other instances, the individual receives a *quid pro quo* for what he surrenders; in fact, the compensating advantages received by him are often infinitely more important to his welfare than his contribution to the common cause by way of rights surrendered. Where the individual is clearly benefited by the surrender of or not claiming the right, both theories of government or social organization agree in their development. Limitations on the activity of the individual, which are clearly for his benefit, are as common to one theory as to the other, but where the benefit to him is uncertain or not apparent and immediate, the disparity begins, and in cases where the benefit, if any, appears to be in favor of the oranization, or where no benefit to either is manifest, the spirit of the individual, who has any notion of independence or any red blood in his veins, resists the encroachment upon his rights and rebels against the restriction. In these particulars is where you find the characteristic differences in the development of institutions under the two theories. In the communistic theory, where there is a restriction on personal activity, the question is never more favorable to the individual than, "Is the limitation or control reasonably promotive of the public welfare?" In the individulastic theory the question is, "Is the limitation or control necessary or indispensable to the public welfare?" The one asks, Is it beneficial to the community? The other, Is it beneficial to the individual affected.

The more nearly the maximum resources of nature are consumed in supporting the people of a community or state the greater the control thereof, which must be assumed by the body politic, and in extremities all individual control must be eliminated. In a fertile country, with a population of only a few inhabitants to the square mile, the control over natural resources may be left entirely to the individual, subject only to such limitations as are automatically imposed by the laws of free competition and natural supply and demand, but where a population of hundreds of inhabitants per square mile must be supported from the niggardly resources of an exhausted soil, all rights of the individual in reference to the control thereof, may necessarily merge in the community dependent thereon. In the former instance the right of dominion of the individual may be absolute and unlimited, except by his own capacity for use or destruction, but in the latter situation he may be limited to the right to use and consume, and that use and consumption may be confined to an amount reasonably necessary to maintain himself and those dependent upon him, in a manner consistent with the rights of the community and most conducive to the public welfare.

Of course, there is no typical example of either form of civilization or government, as both theories have struggled for mastery and each has left its imprint on every community in the world's history. In some countries one theory predominates, and in other countries the other theory is paramount, but neither has at any time or place entirely excluded the influence

of the other. The underlying causes of the individualistic theory are necessarily present wherever men are found, and their conflicting interests very readily produce the occasion for the assertion of the other theory. Continuous has been the struggle between organized society and the ever assertiveness of individuality, and that or this has prevailed according as necessity drove men into combinations or the boundless opportunities of virgin territory tempted them to independence and personal initiative. However, as soon as an equitable distribution of nature's bounty—a distribution not based on the doctrine,

> "They shall get who have the power,
> And they shall keep who can,"

but on the principle of the greatest good to the greatest number—becomes indispensable to the welfare of the masses, the individual must submit to a certain degree of merger into the community and the rights of the latter become paramount.

Where the individualistic theory predominates there is a tendency to regard government as a restriction on the rights of the individual and, therefore, to treat it as a power to be opposed. Man rebels at restraint. Herein lies the explanation of why government under such conditions is regarded as a necessary evil and why the visible expression of law in the form of the policeman is often looked upon with disfavor.

According to the philosophy of our civilization the individual represents the unit of right and power, whereas in the communistic theory the family or the community, or possibly the nation, is regarded as the unit, and the will of the person is subordinate to this super-individual.

Our civilization and, consequently, our jurisprudence have developed along the line of the idea of the independence and pre-eminence of the individual. With us, the source of governmental authority is the will and choice of the people, and it is our theory that law derives its force and effect from the consent of those upon whom it operates. According to our theory the individual existed before the family; the family before the community; the community before the State or Nation, and all these exist for the welfare of the individual; that in their ultimate analysis all laws, whether of the family, the community or the state, contemplate the individual welfare and never lose sight of his rights and wishes. The maxim in our jurisprudence is, The greatest degree of personal liberty and initiative consistent with the orderly and effective administration of the functions of society or of the affairs of government. Illustrations of the influence of the individual in the development of our laws may be found at any point in our history.

The doctrine of caveat emptor is an illustration of how individuality asserted itself in the earliest periods of English development. The trader resented the right of the community to place a limit on the praise he might bestow on the article he was seeking to sell or exchange, and the courts, true to the principle that the other party may be expected to take care of himself, protected him in his panegyrics. Any curtailment of his license in this respect would have amounted to an interference with his right of contract—a right which has always been regarded by our English ancestry as essential to our liberties and which our forefathers magnified to

the extent of ingrafting it into the fundamental law of the land. However, even the casual observer of the tendency of the times must have noted with gratification the general movement in legislation and court decisions to protect society from those who seek to impose upon public credulity by means of false, exaggerated and misleading representations through the medium of advertisements and through the sale of impure foods and drugs and the misbranding of such articles. Even our courts, which should be the last institutions to be affected by the innovations of progress and experience, are gradually taking the civil-law view of the subject, and the harsh doctrine of that highway robber of the common law, *caveat emptor*, is gradually being replaced by a system founded on an enlightened conscience and public welfare. Formerly, the expression of a false opinion was not regarded as actionable either at law or in equity. But this condition has changed. "It is a fraud for a practitioner to pretend, to the detriment of his patient, that he can cure or alleviate a disease when he knows he cannot; or that his patient is improving when he knows, or ought to have known, that the trouble is not being relieved; or that he understands the nature of the malady, when in fact he is ignorant thereof."[1]

Even the criminal was protected against the society he had wronged, by placing the burden upon the latter in any effort to convict him of his offense and bring him to punishment. He is entitled to a presumption of innocence, and that presumption abides with him until by competent evidence he has been proven guilty of the offense as charged beyond a reasonable doubt. "Better that 99 guilty escape than that one innocent should suffer," runs the slogan. The individual was more than 99 times as important as the community. One man can commit a crime but it takes the unanimous verdict of twelve men to establish his guilt. He must be confronted by all witnesses who appear against him; that is, all cards must be on top of the table, and some courts practically require that they must be turned face up and played as required by the criminal. The taxable costs in litigation are never adequate to compensate the wronged party for his trouble and expense, thus, practically encouraging resort to courts to settle differences and to assert personal independence.

Notwithstanding the preponderating influence of the individualistic theory of government in the American colonies at the time of their organization into one union, there were ingrafted into that government many features of the other theory. As an example we may cite the establishing, at public expense, of post office and post roads and, soon thereafter, of systems of public free schools and internal improvements.

In fact from the earliest establishment of order in our system of jurisprudence the supremacy of the state over the individual in matters pertaining to the comfort, morals, order, peace, safety and welfare of the public has been recognized in what is indefinitely called the police power. The courts have not attempted an exact definition of this term but the central idea is that it is a right lodged in the community as a whole to regulate and control the action of its individual members in all matters wherein the rights of the public in relation to the matters aforesaid are concerned. "The police power is that inherent and plenary power in the state over business and prop-

1.—Brothers: Medical Jurisprudence, p. 197,. C. V. Mosby Co., 1914.

erty, when expressed in the legislative will, which enables the people to prohibit all things inimical to the comfort, safety, health and welfare of society and is sometimes spoken of as the law of overruling necessity."[2]

This is a latent power which will always be called into active being whenever the occasion for its exercise arises and the tendency in the direction of enforcing the rights of the community as against the rights of the individual is shown in the repeated application of this doctrine of the police power.

While in English-speaking countries, especially in the United States, the individualistic theory of government has its highest development, yet even into many of our contractual relations the law has injected duties and benefits not always contemplated by the parties themselves. Take the marriage relation as an example: Irrespective of what the parties to the contract may have had in mind, they immediately become incompetent of occupying a similar relation towards any other person in the world, and the incompetency continues until the death of one of the parties or until the relation is dissolved by due process of law for cause specified by the law. It cannot be dissolved by agreement of the parties themselves. The husband is bound to support the wife and both are bound to support their off-spring, and the law assumes to interfere with any effort on the part of either to interfere with the course of nature in the production of off-spring. Subject to certain limitations, "Where the husband furnishes the flour the wife must bake the bread." Each spouse acquires a contingent interest in the property of the other. Some of these provisions are intended for the benefit of the individual spouse and others are intended for the benefit of the social community.

A great deal of the so-called industrial and progressive legislation and agitation of the last few years is a movement in the direction of the communistic idea of government, in an effort to implant into our industrial and social fabric some of the results of that theory. The agitation is perhaps accentuated by reason of the large influx from the populations of continental Europe, where the latter theory predominates. Changes of such fundamental character should not be undertaken without the fullest consideration of their ultimate effect on our industrial and social system. Illustrations will readily occur to the reader, but reference to one will suffice to explain our meaning,—the so-called old age pension system. If, in his decrepitude the individual is to reap the benefit of provisions made possible by the communistic organization of society, should he not in his maturity bear some of the burdens of that form of organization, whereby the payment of the benefits is made possible? We cannot eat our cake and have it too. If we expect support from the community or government we must give a *quid pro quo* by contributing our proportion to the fund from which, in time of need, that support may be drawn. If we expect the benefits we must bear the burdens. If we persist in treading the "primrose path of dalliance" in our youth and manhood we must not expect too much when the fires of passion have gone out. We must not apply one theory of the relation of the individual to the community during his effective manhood and a different theory in his useless decrepitude. The question is—Are we ready to surrender any portion of

2.—Brothers: Medical Jurisprudence, p. 272.

that personal independence which has been the boast and crowning glory of our social organization?

There is no disputing the fact that such a system in its entirety, has the essential element of justice by making each mature generation take care of itself. In our present system each generation is taxed with the support of the immature of the coming and the derelicts of the past generation, and the burden is generally, specifically, imposed according to relationship. If we are to change the system we ought to change the theory. If we want such an innovation we must pay the price. To be entitled to the profit we must make the investment. It is desirable further to control individual action by *compelling* men to work, economize and save against the exingencies of the future?

In the relation of the individual to the community or state, from the earliest times, our law has imposed upon every individual certain duties and responsibilities for the welfare of the community; among which may be mentioned the duty to use reasonable care and caution not to injure others by his acts. By reason of the congestion of individuals into thickly populated communities this latter duty may so circumscribe the individual by restrictions as to leave him almost without any personal initiative. The relation of members of any of the professions to those with whom they deal is impressed with many obligations not contemplated by the parties at the time. The exercise of skill, care and judgment are indisputably presumed to be engaged for in all the professional man undertakes to do, and the law will not permit him by special agreement to relieve himself of that burden. What the law imposes for the benefit of the public, the law only can relieve. Speaking of the professions, it is in the subject of the right of the individual to practice a given profession that there is gradually being wrought in our jurisprudence the greatest limitation upon the rights of the individual.

"At common law any one might practice medicine or dentistry or perform surgical or dental operations. No preliminary preparation and no license to practice were required as a matter of law. This condition was also true on the continent of Europe within the jurisprudence of the civil law. Of course the practitioner was responsible to his patient for the exercise of an ordinary and reasonable degree of skill and knowledge, as measured by the standard of proficiency and professional learning at the time; but the State did not then attempt to prohibit incompetent persons from practicing nor to regulate the standard of proficiency by establishing a minimum standard of qualification. To adopt and follow such lawful pursuit, not injurious to the community, as he may see fit, is a fundamental right and privilege of every American Citizen."[3]

However, as is said by Justice Field in Dent against West Virginia, 129 U. S., 114, 121, "the power of the State to provide for the general welfare of its people authorize it to prescribe all such regulations as may be and are necessary to secure the people against the consequences of ignorance and incapacity as well as deception and fraud."

"The public welfare requires not only competence in the practitioner but also morality, general uprightness, respectable appearance and reasonable obedience to law. A grossly immoral or criminal practitioner is more

3.—Brothers: Dental Jurisprudence, p. 103.

dangerous to society than one who is merely incompetent and, therefore, good moral character and a record free from crime are universally required of applicants, and the courts have universally held such provisions constitutional. While such laws are an invasion of the common law right of the individual, they are justified on the ground of public necessity. Ordinarily the law cannot interfere with the freedom of private contract. Why should the citizen not be permitted to engage whomsoever he pleases to administer to him when he is sick or relieve him of dental troubles when they assail him? The answer is, *The public must protect itself against imposters, fakers, charlatans, ignoramuses and quacks.*"[4]

If we are to adhere to our individualistic theory of government and not entirely obliterate the individual in behalf of the state, a restriction on the person to practice a profession should have some reasonable relation to the objects to be attained. Any restriction or control over the individual in this respect should appear to have in view a reasonable promotion of the comfort, good manners, health, life, morals, order, peace, safety and welfare of the citizens of the state.

"The requirement that an applicant for examination for license to practice must be a graduate of a college or school or some particular class of school is not only unreasonable and unjust but also not reasonably promotive of the object to be attained—the selection of fit and competent persons. How or when, or where, or within what period of time the qualifications were attained, are matters in which the public is not concerned. The only test should be,—*Is the party competent, worthy and fit to practice the profession?* What he has, not where he got it, should be the subject of inquiry. What he can do, not where he acquired the ability nor how long it required him to attain proficiency, is the element of public interest and inquiry. A requirement that a party must be a graduate of a particular college or particular class of college, is unfair discrimination which the public should not tolerate. It excludes the competent citizens who acquired their information in other schools or by private tuition and instruction. If does not answer the objection to say that the requirement excludes only the incompetent, that is, only those who cannot stand the required test as to proficiency. The existence of the rule presupposes the contrary. If such rule excludes only the incompetent then why not eliminate them by the usual examination—the same process by which other incompetents are excluded. If present standards and methods of examination do not eliminate all incompetents then better change the standard or the method of examination. The trouble is, the limitation in question is intended to get rid of, not the unqualified, but a class regardless of qualification and fitness and, as such, is an unjustifiable exercise of the police power."[5]

However, it must be admitted that some legislatures, and also some courts, have overlooked the origin of the right to restrict and control the individual in these respects and have passed and sustained many restrictions and regulations which are not primarily promotive of the public weal and, therefore, in view of the tendencies above indicated it would be folly indeed to attempt to predict how far our courts will go in sustaining legislation which

4.—Brothers: Dental Jurisprudence, p. 105.
5.—Brothers: Dental Jurisprudence, p. 106-7.

has for its apparent purpose the protection of the community by restricting and controling the action of its members in their occupations and professions.

The tendency of legislation towards the protection of society against the individual is further illustrated in the multiplicity of the laws prohibiting the advertising of cures or remedies for certain diseases and ailments, usually those of a venereal character, and making it unlawful for a person to advertise himself as a specialist in the treatment of such diseases. The reason for such legislation is forcefully stated by the court in a recent case in Oregon as follows:

"For many years it has been recognized by publicists and legislators that some drastic action is necessary to check the social evils and to protect youthful and inexperienced humanity, not only from easy access to vicious and immoral practices, but also from the schemes of designing men who for the sake of financial profit would pray upon the calamities of the unfortunates who have sowed the wind and reaped the whirlwind * * * * * * * * *. The act spreading broadcast, by means of advertising, the idea that certain venereal diseases are easily and cheaply cured is against public policy, in that it has a decided tendency to minimize unduly the disastrous consequences of indulging in dissolute action * * * * The purpose of the act is clearly in the interest of the public morals."

Legislation prohibiting the advertising of liquors in dry territory has been upheld as being within the police power and reasonably promotive of the public welfare. The fact that in practice such regulations discriminated against the people of the State was not sufficient to invalidate the law.

Industrial legislation pertaining to hours and conditions of labor, safeguarding the life, health and morals of employes, minimum wage, employment of minors and women, form of payment of services, and many other kindred subjects, is promoted and sustained by the fact that the welfare of the community is the paramount consideration in industrial life, and that the rights of the individual must be made to harmonize with the requirements of the public. The tendency toward compulsory attendance at school is another form of the assertion of the rights of society over the individual and is an assumption by the State of some of those responsibilities which have heretofore been placed exclusively upon the individual parent or guardian. However, in the complex relations of individuals when congregated into large municipalities is where we find the greatest regulation and control of the individual for the welfare of society. The paramount interest of society is the basis of the law announced by the courts whereby charitable institutions are exempt from responsibility for the negligence of their servants causing injury to their patients. For the same reason the soverign State is excused from liability for the torts of its employes or servants in their governmental capacity.

The assertion of the supremacy of society over the individual and the regulation of his energies for the common welfare is seen in requirements pertaining to the services of medical practitioners for infants afflicted with disease. Even religious scruples must give way to the prevailing sentiment of the community notwithstanding the disease may be of such character as to affect only the infant afflicted. "The law is based upon the assumption that the medical services were a necessity and applies wherever the party

sought to be held responsible is charged with the duty of supplying the minor with necessities."[6] It has been held that the parent is criminally liable for refusing to consent to a surgical operation upon his minor child.

It may be safely predicted that the time is not distant when parents, guardians and others to whose care the law commits the young will be required, under penalty, *to have the defective jaws and mouths of their wards treated and corrected by the orthodontist*, in cases where such treatment will conduce to the health, comfort or happiness of the ward.

A PLEA FOR CONSERVATION OF THE CEMENTUM.

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THE object of this paper is a plea for less heroic instrumentation and greater conservation of the cementum on the roots of teeth affected by pyorrhea alveolaris. When a failure of union between the peridental membrane and the root of the tooth occurs after heroic instrumentation has been instituted, it is not because the peridental membrane has been removed in its entirety, for, on scaling the roots of the teeth, only the ends of the fibers attached to the cementum have been cut and partially removed, while the fibers of the alveolar surface are often intact. The failure of union results because the operator, in his heroic scaling, has removed the basal layer of the cementum, and the dentin of the root of the tooth is exposed. Even if a few islands of the cementum are left on the root of the tooth, the area of destruction of the cementum is proportionately so great that the remaining cementoblasts (or lacunæ) are unable to regenerate the cementum to such an extent as to replace the destroyed cementum.

The popular teaching at the present is that the peridental membrane carries in its substance the cementoblasts and that the development of the cementum is dependent on the peridental membrane. This teaching the author believes is not correct, for the reason that the peridental membrane histologically is an exact counterpart of the periosteum. One needs to do nothing more than examine a slide made from a section which shows the root of the tooth *in situ* in the alveolus to be convinced that such is the case. And further, the author believes it is impossible for one to place the pointer of the eye-piece at a definite point, and state that the tissue at one point is peridental membrane, while that at an adjoining point it is periosteum, for histologically there is no evidence on which one can make an actual differentiation. In lieu of the work done by MacEwen of Scotland, in which he shows, by experimental evidence, that the periosteum does not carry osteoblasts in its substance, and further that the function of the periosteum relative to the formation of new bone is that of a limiting membrane; the author, in his examination of a large number of slides of sections which he has made of the root of the tooth in the alveolus taken from the human mouth in the

6.—Brothers: Medical Jurisprudence, p. 263.

morgue, has not, up to the present, observed any free cells in the substance of the peridental membrane in the vicinity of the cementum, which morphologically resembles the cementoblasts described by Black and Noyes. The peridental membrane, the author believes, is a limiting membrane for the cementum and the alveolus. Vitally, the fibers of the peridental membrane have a direct affinity for the cementum and if the cementum is absent the fibers do not find a surface which is adapted to their need, and no union occurs. The fresh surfaces produced by instrumentation offer the epithelium of the mucosa of the mouth an excellent field for their growth, and after variable periods of time they creep over the margin which separates the epithelium from the periosteum (Fig. 1) and soon commence a natural process of growth, forming a covering for this surface. The fibers of the peridental membrane near the cementum are absorbed, and the alveolus in this area is now covered with a tissue composed externally of mucous membrane, and internally of

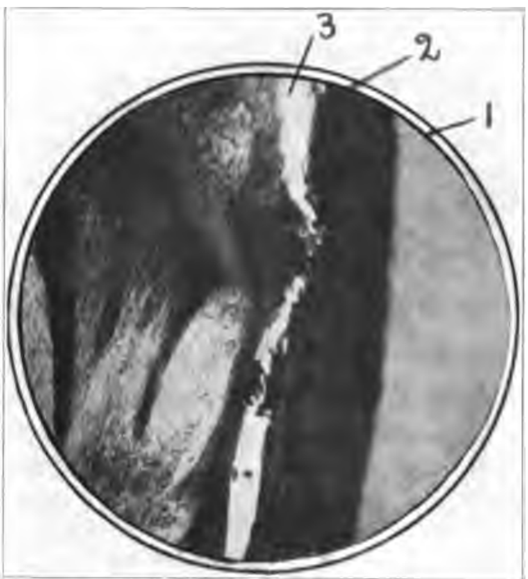


Fig. 1.

peridental membrane. Of course, when this process occurs, we cannot expect a union of the fibers of the peridental membrane with the root of the tooth. The normal arrangement of the fibers of the peridental membrane and their relation with the gingivus is shown in Fig 2. At (1) we see the fibers of the peridental membrane attached to the cementum, which is the small black area at the left border of the picture. At (2) we see the tip of the alveolar border and at (3) the periosteum of the alveolar process and the manner in which the fibers of the peridental membrane are continuous with the fibers of the periosteum, as has been shown by Noyes. By comparing Fig. 2 with Fig. 1, the difference between a healthy gingivus and a diseased one can be seen.

The periosteum regenerates when it is destroyed. Marchand and others have reported this, and it is now accepted as a fact. If, however, supperation and infiltration of the outer tables of the bone occur by suppurative organ-

isms, necrosis is inevitable. The necrosis, however, does not cause a total destruction of the periosteum and according to Marchand, the following condition is found. The new periosteum, in its growth, becomes firmly attached to the bone, and is separated from the overlying connective tissues. The old periosteum shows a marked thickening of its fibers, which are ar-

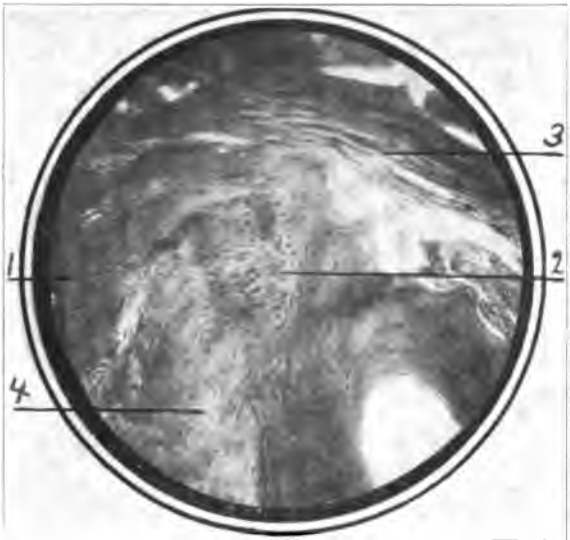


Fig. 2.

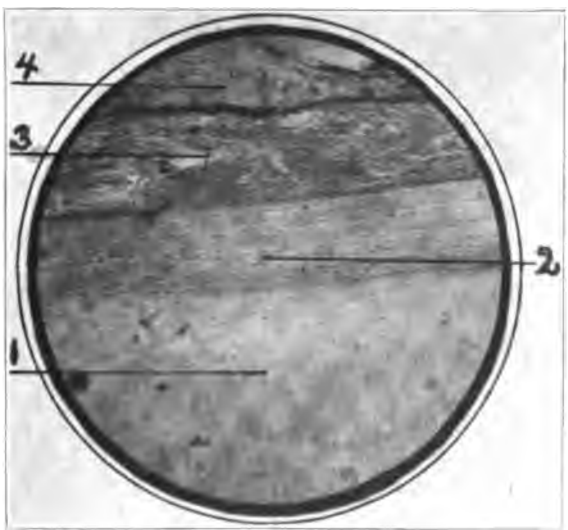


Fig. 3.

ranged along the long axis of the bone. They exhibit a radial development and suggest a definite growth of the fibers from the periphery. The author, believing as he does that the periosteum and the peridental membrane are one and the same tissues histologically and functionally, is of the opinion that when the peridental membrane is destroyed by instrumentation or

disease in a given area, and this area is not covered with mucous membrane, that the peridental membrane will regenerate the same as the periosteum regenerates. And further, if the basal layer of the cementum has not been destroyed, the basal layer will regenerate the cementum, and that a union of the peridental membrane with the cementum will occur. Clinically, the author has seen many instances where a union of the peridental membrane with the root of the tooth has occurred, and this evidence he has shown Drs. Dewey, Allen, Evans, and Lobenstein.

The cementum of the root of the fully developed tooth, when examined with the high power, shows lacunæ and canaliculi, which, histologically, are the same as the lacunæ and canaliculi of the alveolus; but the cementum of the root of the tooth differ from the alveolus in that a complete haversian system has not been demonstrated. This, however, may be the fault of

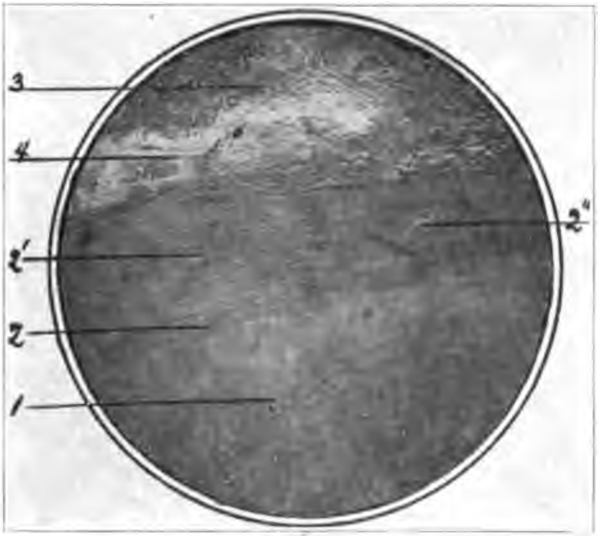


Fig. 4.

technic, or our inability at the present time to connect the canaliculi with the surrounding tissues.

The author believes the cementum laid down in the process of the development of the tooth the same as any other part of it.

The cementum, being an exact counterpart, histologically, of bone, it is rational to assume that, like bone, this tissue regenerates the same as bone does, and again we must refer to the work of MacEwen in which he states that bone regenerates in one of two ways, namely: "In adult life, regeneration takes place either through a transitional stage of cartilage, or by direct division of bone cells into osteoblasts. Where the conditions are most favorable, the osteoblasts are formed directly from the bone cell and ossification is hastened; but when conditions are less favorable, the cartilage cell is formed, and ossification is retarded."

In the next picture (Fig. 3) we have a cross-section of the root of the tooth including the alveolus. Beginning at the dentin (1) and passing

upward we note the cementum (2), and it will be seen that the cementum at this point is laid down in concentric lamella. The cementum (2) in this picture is laid down in uniform thickness and likewise density. Continuing upward in the picture, we note that between the cementum (2) and the alveolus (4) the peridental membrane (3), which, like the cementum, is uniform in its thickness between the cementum and the alveolus. At the left, in the peridental membrane, we note a light area, which in all likelihood, is a focus of disease of the peridental membrane. The alveolus (4) shows some lacunæ, and in this area is approximately normal. By studying this picture we become oriented as to the relation of the dentin, cementum, peridental membrane, and alveolus. This picture, the author believes, represents the normal relation of the root of the tooth and its dependent tissues.

The normal tension of the peridental membrane is present in Fig. 3, while, as we advance to Fig. 4, we find that such is not the case. In Fig. 4,

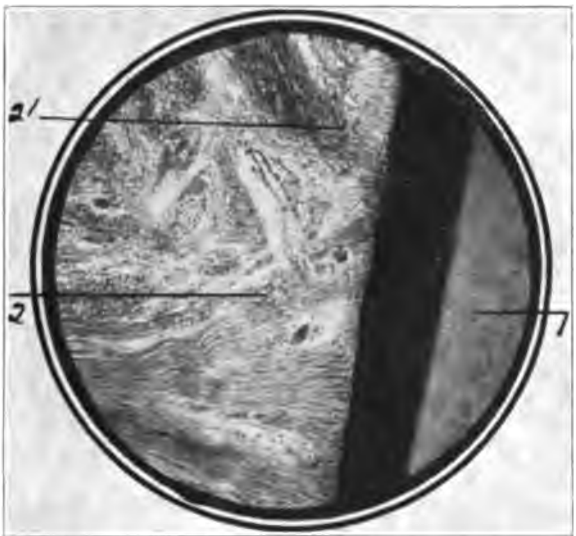


Fig. 5.

beginning at (1), which is the dentin, and advancing upward to (2), we observe the granular layer of Tomes. Continuing upwards, we observe the cementum proper above the granular layer of Tomes (2, 2^1, 2^{11}). By comparing the thickness of the cementum (2^1) to (2^{11}), we note at once that the cementum at (2^1) is much thicker than at (2^{11}). On further study we note that in the substance of the peridental membrane situated opposite the cementum (2^1), there is a very light area in its substance (4). With a higher magnification, we note that this area is filled with a fine granular derbis and many round cells. The presence of this diseased area in the peridental membrane has impaired the normal tension of the peridental membrane for the cementum. We are now in a position with the aid of this picture to

The author does not believe that the peridental membrane is the correct name for the tissue that lies between the root of the tooth and the alveolus, and further, that this tissue is the periosteum of the alveolus of the root socket, and because of the homology histologically of the cementum to the alveolus some of the fibers of the periosteum pass across and unite with the root of the tooth, and thus serve as a ligament to hold it in its correct position. To prevent confusion in the mind of the reader, the author will use the terms "peridental membrane" and "cementum".

substantiate the premise, namely, that the peridental membrane is a limiting membrane between the tooth and the alveolar wall, and is the medium of attachment between the tooth and the surrounding gingival tissues. Also, that the cementum is not developed from the peridental membrane, and that the cementoblast is not a cell which is developed from the peri-

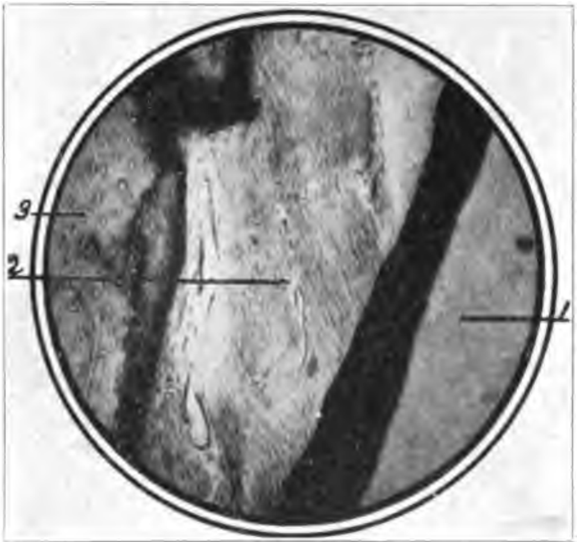


Fig. 6.

Fig. 7.

dental membrane, but comes from the lacuna of the cementum. The repair of the cementum is the result of activity of the cementoblast, which arises from the basal layer.

Immediately to the cemental side of (4), the light area in the peridental membrane, we find a thickening of the cementum. If the cementoblast

came from the peridental membrane there would be a lack of development of the cementum, as in such areas we find the peridental membrane diseased instead of a thickening as occurs near (4) in Fig. 4.

In Fig. 5 we have a longitudinal section of the root of the tooth. Beginning at (1), which is the dentin, and advancing to the left in the picture, we observe a dark broad line, which is the cementum; and continuing laterally we observe fibers of the peridental membrane sweeping across from the alveolus, and uniting with the neck of the tooth (2 and 2^1). One of the bundles of the peridental membrane (2^1) is fan-shaped, some of the fibers passing upwards, while others pass downward in their course toward the root of the tooth. The fibers (2^1) pass downward and then just before uniting with the root of the tooth they are bent slightly on themselves, and unite with the root of the tooth. The light area observed in this picture is occupied by round cells.

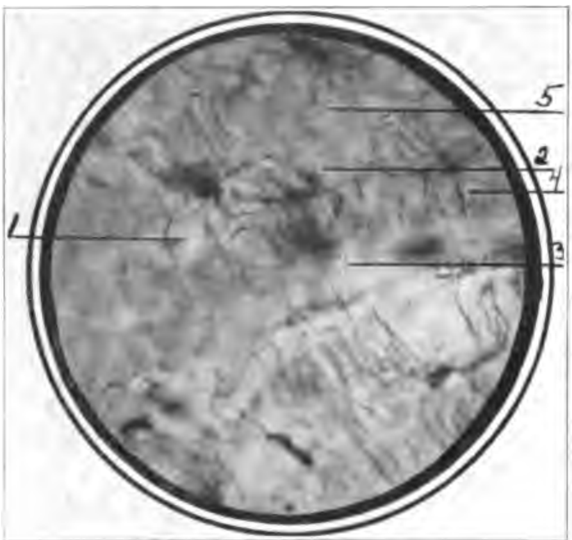


Fig. 8.

In Fig. 6, we note the fibers of the peridental membrane passing into the root socket proper, and that they are entering at an angle. This angle of the fibers is maintained practically to the end of the root. (1) is the dentin. The dense black line noted between (1) and (2) is cementum. (2) is the peridental membrane, and (3) is the alveolus. A careful study of this picture, the author believes, shows that the fibers of the peridental membrane are more securely attached to the alveolus than to the root of the tooth, and the fibers pass from the alveolus to the root of the tooth, and not from the root of the tooth to the alveolus. The nature of the membrane, as shown in Fig. 6, is such as to suggest the structure of a ligament, and it is the author's belief that the peridental membrane has no more to do with the development of the cementum than the tendon of a ligament has to do with the development of the bone.

Having thus considered the peridental membrane, let us now study some of the pictures of the alveolus. The first picture (Fig. 7) is a low power

photomicrograph. On close observation, we note that in the entire field there is one haversian canal (1), and that scattered throughout the field, without any definite arrangement in the main substance of the alveolus, are many lacunæ (2). At (3) there is a small clump of red blood corpuscles, and at (4) another clump of red blood corpuscles may be seen. The striking feature of this illustration is that, if a picture of the same area of bone which is laid down in cartilage is examined, it shows a far greater number of haversian canals than does the alveolus. The alvelous is what is termed cancellous bone, and contains a large number of medullary spaces and few haversian systems that are complete, but we often see the remains of an haversian system, part of which has been absorbed.

In Fig. 8 we have a quite high magnification of the alveolus (780 diameters). On careful examination of this picture, one notes that the canaliculi (1, 2, 3, 4, and 5), all communicate with each other. We must orient

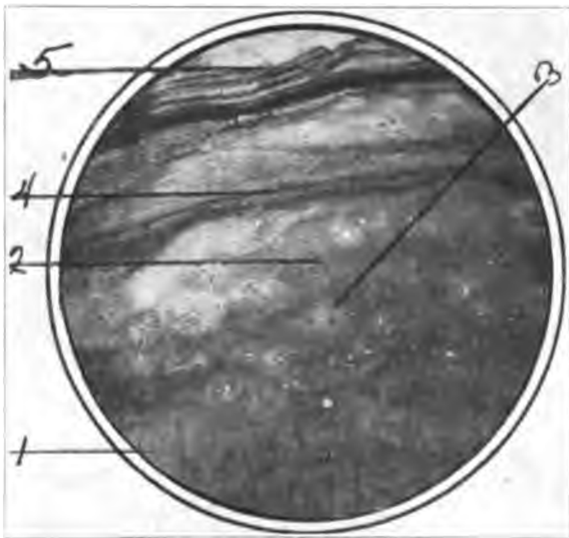


Fig. 9.

this histological observation for the reason that we will, in another part of this paper, show the lucanæ and canaliculi of the cementum. The similarity between the lacunæ and canaliculi forces us to consider that cementum and bone are tissues which are very closely related.

Fig. 9 is a cross-section of the root of a tooth showing a hyperplasia of the cementum. Beginning at (1), which is the dentin, and passing upward, that is, toward the alveolus, we observe that the granular layer of Tomes is absent, or at least poorly shown, and that in its stead are large cells (3). Howship's lacunæ are observed. In true bone when it is undergoing a process of destruction, their presence represents the stage which is associated with the osteoclast. Again we are confronted with a process which is the same as observed in bone. (2) is the cementum which is not affected but in all likelihood it would at some future time have been invaded by Howship's lacunæ had the person lived when this specimen was obtained. The lamella

(4) are very compact when compared to the lamella above, which are homogenous in structure, and contain in their substance lacunæ, but no Howship's lacunæ. Above this lamella of the cementum, we observe another lamella (5). The lower lamella is very compact while the upper one exter-

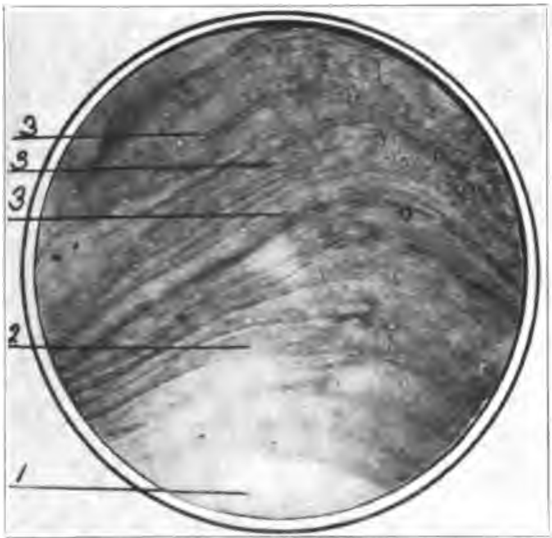


Fig. 10.

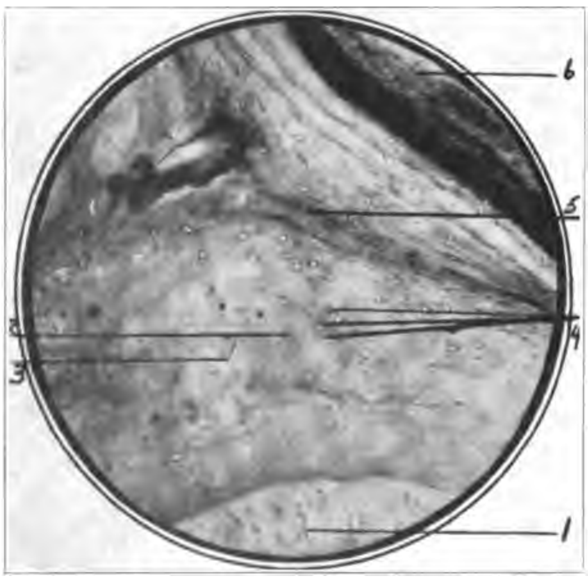


Fig. 11.

nal to it, although compact, shows fine perpendicular lines which we believe are calcified areas around the fibers of the peridental membrane.

In Fig. 10 the cementum occupies the entire field. Commencing at the lower portion of the picture at (1), we note that the lamella of the cementum

are narrower (2) than they are as we pass farther upward. Scattered without any definite arrangement in the outer lamella of the cementum we note (3, 3, 3) lacunæ, some of which stand out in bold contrast to the cementum, while others are not so sharply outlined. This, however, is not because they are absent, but is due to the fact that in focusing the microscope

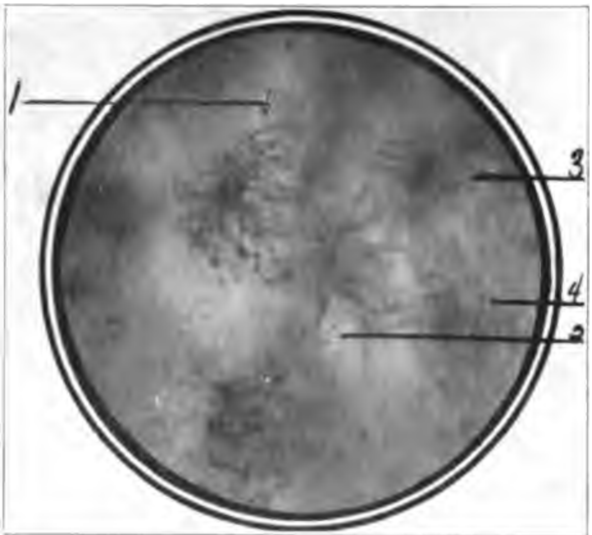


Fig. 12.

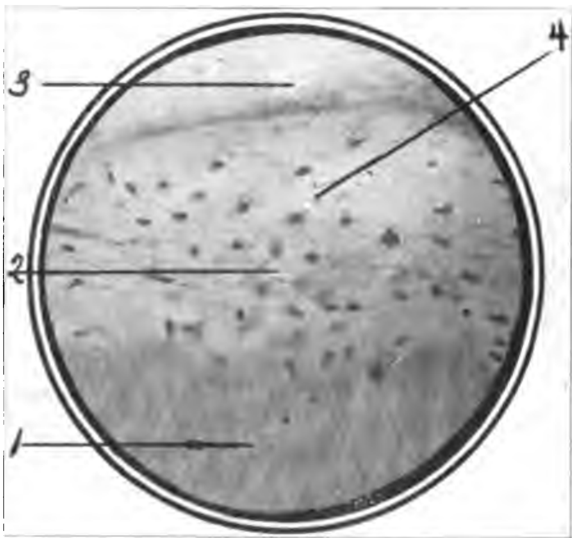


Fig. 13.

many of them are lost because they are out of focus. The cementum shown in this field, though markedly increased in amount, the author believes represents completely calcified cementum.

In Fig. 11, commencing at (1) which is the dentin of the root of the tooth, and advancing upward in the picture, we find an area which is free from

Howship's lacunæ (2, 3). The lacunæ of the cementum are shown at (4). Here as in Fig. 9 we observe that the granular layer of Tomes is absent and that in its stead we find Howship's lacunæ, and to explain their presence would be a repetition of the former description.

Having thus described the hyperplasia of the cementum, let us now

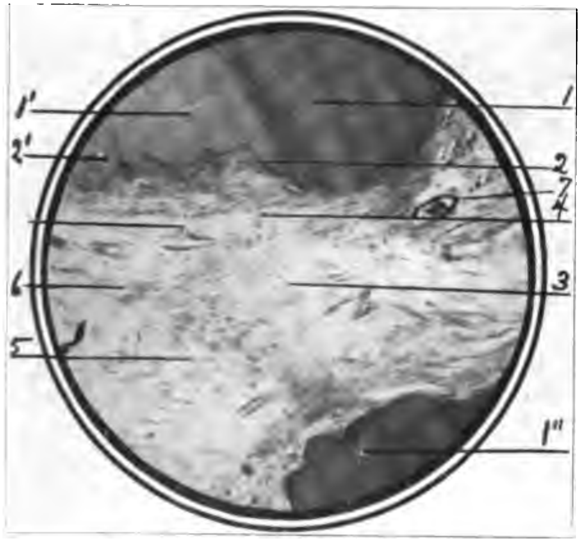


Fig. 14.

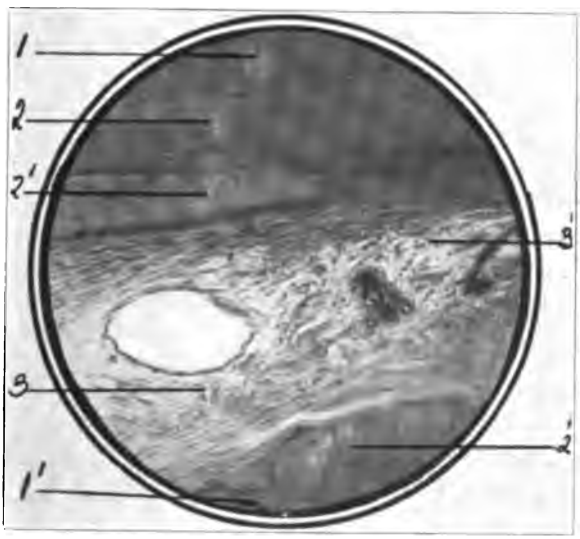


Fig. 15.

examine a high-power photomicrograph of the lacunæ and the canaliculi of the cementum. The canaliculi of the lacunæ (1, 2, 3, and 4 of Fig. 12) all show a communication with each other. This evidence, the author believes, is sufficient to substantiate the question of the regeneration of the cementum from these cells, and not from the cells contained in the meshes of the peri-

dental membrane. MacEwen, in his work, states that if the bone cells are of the same size as the cells which have been destroyed, that they become osteoblasts and thus rebuild the lost bone. The more one studies the slides on the question of the formation of the cementum the less one sees to suggest that the cementum has its origin in the fibers of the peridental membrane. One has but to compare the lacunæ of the bone with the lacunæ of the cementum to see the similarity between the two. Also there are no cells found within the substance of the peridental membrane resembling the lacunæ of the cementum which we believe are the real cementum builders.

By comparing the canaliculi of the cementum with those of the alveolus, the author conscientiously believes that an expert could not differentiate them. Thus, again we are confronted with the fact that cementum at a high magnification has all the earmarks of true bone, except the haversian system, which may be demonstrated later.

Fig. 13 is taken from one of the fragments of the fractured root near its apex. Examination of this picture shows the dentin of the fragment of the root at (1). As we advance from this area, we observe the cementum at (2). In the substance of the cementum, we note many lacunæ, and on careful examination of the picture, faint outlines of some canaliculi are discernible. We do not observe any of Howship's lacunæ, nor do we see the granular layer of Tomes, or the interglobular spaces, but we do see that the cementum is in direct contact with the dentin of this portion of the root of the tooth. (3) is the very faint outline of the peridental membrane.

Fig. 14 is taken from a field which shows the break in the continuity of the cementum as the result of a fracture near its apex. (1) and (1^{11}) are the outer lamella of the cementum, (1^{1}) is the lower lamella of the cementum, (2) and (2^{1}) is the newly formed cementum from the basal layer of (1^{1}), (3) is fibrous tissue, (4) round cells, (5) a few fibroblasts, (6) arterioles, and (7) blood vessel. If cementoblasts were present in the peridental membrane, the author sees no reason why they should not be shown at this point, as there is evidence of the formation of cementum on the fractured fragments.

In Fig. 15 the fracture of the root is very well shown. (1) and (1^{1}) is the dentin. (2, 2^{1} and 2^{11}) is the newly developed cementum on the broken surface of the dentin. (3^{1}) Shows round cells, while (3) shows normal fibers of the peridental membrane. In this picture we do not see present in the peridental membrane any cells which morphologically resemble the cementoblasts with the higher power observation. In neither Fig. 14 nor Fig. 15 do we observe the granular layer of Tomes, and likewise Howship's lacunæ are absent.

From the conditions presented by Figs. 13, 14 and 15, we are confronted with the evidence that the cementoblasts are not deposited by the peridental membrane, but that they are regenerated from pre-existing cells of the same type, and that the process of the regeneration of the cementum is the same as noted in bone. That is, if the cells are of the same size as the cells destroyed, they can become active proliferating cells, and that the regeneration of the cementum is dependent on the presence of this type of cell for its regeneration.

Therefore, in the treatment of such conditions as involve the gingival border of the tooth, more care should be given to the conservation of the cementum than has been given in the past.

THE HISTORY OF ORTHODONTIA.

(*Continued from page 58*)

BY BERNHARD WOLF WEINBERGER, D.D.S.
NEW YORK CITY.

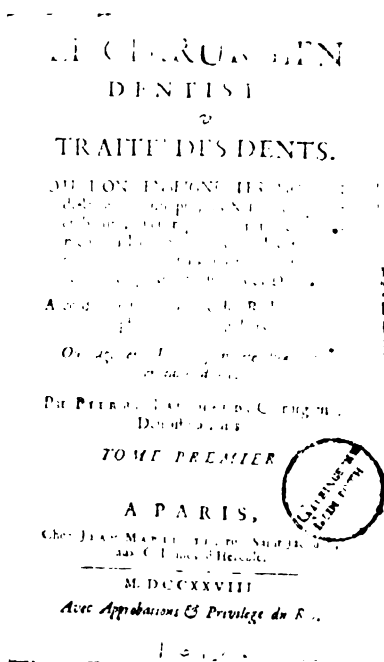
PIERRE FAUCHARD, born in Paris in 1690, was the first to write a treatise on purely dental subjects, with the idea of putting all he knew about odontology in a manner that would be of the greatest help and interest to those who succeeded him. In 1728, he published "*Le Chirugeon Dentist*" in two volumes, which served its purpose so well that it remained an authoritative work for over half a century. The second edition of Fauchard's work (1746) contains (pp. 275-277) the first definite account of pyorrhea alveolaris. He describes the microscopic structure of enamel and devotes a good deal of attention to the health of the teeth and their preservation. A long chapter is devoted to opiates, powders, and various mouthwashes, but the prescriptions, according to our present idea, would hardly be accepted. His treatise marks a distinct epoch in the progress of dentistry, and may truly be regarded as the first of the publications in France during the eighteenth century. He was the father of dental science in that he first advocated special education in dentistry, and did what he could to advance this by publishing his methods and experiences for the benefit of others.

In the first chapter of his work, Fauchard speaks of the structures, position, and connection of the teeth; of their origin and of their growth. He distinguishes in each tooth a body, a root, and a neck. "Although in the adult the number of the teeth is normally thirty-two, it may be that some persons have, nevertheless, thirty-one, thirty, twenty-nine, or even only twenty-eight teeth, and this independently of any eventual loss, but for the simple reason that the wisdom teeth are often cut very late in life (even after fifty years of age) or do not all come forth, or sometimes are never cut at all." The author refers to some cases of a supernumerary tooth situated in general between the two superior central incisors and similar in form to the lateral incisors. Fauchard declared the popular opinion expressed also by some ancient authors, of the milk teeth having no roots, to be false. "The roots of these teeth," he says, "are gradually worn away before the latter are shed, when the permanent teeth are just on the point of coming through, however, if it so happens that one or more of the milk teeth he extracted before the period in which they are usually shed, their roots are found to be long and as strong in proportion to the body as those of the permanent teeth. In children one finds, besides the twenty deciduous teeth, the germs of thirty-two permanent ones, for which reason it may be said that children have all thirty-two teeth without counting the germs that may sometimes be found at the extremities of the roots of the large molars. As, however, the existence of such germs is an exceptional fact the twelve large molars, if extracted, are not ordinarily regenerated."

Many before him wrote concerning irregularities of the teeth and their treatment, but as far as records show, there are few appliances mentioned. The form of the first appliance or by whom used is not known. There is

no doubt but that it dates further back than the seventeenth century, owing to the secrecy in which the dentists of the time held their knowledge, and as Fauchard mentions that the appliances did not originate with him, probably more regulating appliances were invented than we have knowledge of. However, the first important appliance that marks a distinct step in our specialty was described and given us by Fauchard in 1746. Its chief function was to expand the arch, its form assuming that of an ideal arch, and has been known as a band, bow, bandellette, and short and long band, but in

Fig. 1.—Pierre Fauchard (1690-17....). Father of dental science.



TRAITE DES DENTS.

TOME PREMIER

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Fig. 2.—Title page. Pierre Fauchard (1728).

reality it is nothing more than what we now know as the expansion arch, with later modifications by Bourdet (1757), Fox (1803), Delabarre (1819), Schange (1841), Harris (1850), Farrar (1888) and Angle (1889). Without doubt its introduction marks the most important step in the history of regulating appliances, and although many of the appliances seem crude, bulky, and so inconvenient that they were seldom adopted, nevertheless the mechanical principles of the arch is the same today as in 1728.

To take up in detail Fauchard's work, would require more space than I can devote, however, his chapter on irregularities is so interesting that I

feel it is not more than proper to dwell on certain parts of same. He relates twelve cases of dental irregularities corrected by him with satisfaction and at times surprising results, also mentioning the similar methods of preceding dentists for moving teeth, such as finger pressure, common or silk threads (waxed), bands of gold and silver and other suitable material, and the pelican or straight forceps.

In reference to the bands, or now so-called expansion arch, he says: "If the teeth are much out of line and cannot be corrected by means of threads (gold), it is necessary to use a band of silver or gold. The width of the band should be less than the height of the teeth to which it is applied. The band

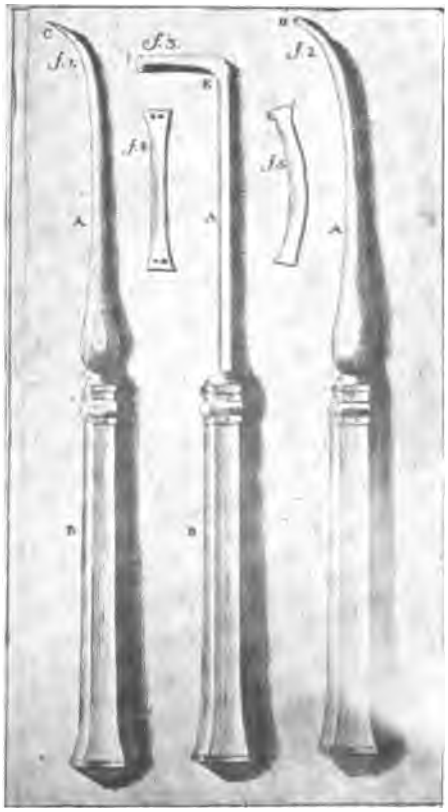


Fig. 3.—(4, 5) Silver appliance used by Fauchard to correct irregularities of the teeth. As far as known, the first important appliance used for this purpose. (1, 2, 3) Three instruments for filling teeth.

must be neither too stiff nor too flexible. Two holes are made at each end, a thread, which passing partially through forms a loop in the middle of each thread. If the tooth is inclined outward the band is applied exteriorly; if it is bent inward it is applied inside the teeth. The nearest of the upright teeth to those that are bent are then encircled with the ends of the threads, which, passed from the exterior to the interior of the arch, or from the interior to the exterior, as the case might be, finally having crossed a number of times, are tied and their end cut off."

When one end is fastened the other is treated in like manner. By the pressure and support given the band the inclined tooth will be made upright

in a short time. Fauchard, it seems, was not the only dentist of his time who attempted correcting irregularities, but with his invention he no doubt obtained more rapid and satisfactory results.

The teeth of young people, he says, are easier to straighten than older children, as the roots are not as large, and partially because the surrounding parts are softer. When persons of some years undertake this operation, considerable time is required before success can be obtained. On account of this slowness, Fauchard attempted quicker and less difficult means, namely, the use of the pelican: in this manner he could accomplish in a few hours what formerly required months with the band or wax threads.

"In Chapter XVIII the author relates twelve cases of dental irregularities corrected by him with satisfactory and at times even surprising results. We here refer, in Fauchard's own words, to the last two of these cases, not because of their being the most important, but from them it is evident that Fauchard was not the only dentist who undertook such corrections, although he was perhaps the only one who, in certain cases, carried them out with a rapid method.

"In the year 1719, M l'abbe Morin, about twenty-two years of age, whose countenance was greatly deformed from the bad arrangement of the incisors and canines, consulted various colleagues of mine as to the possibility of correcting the irregularity of his teeth. Some found the thing so difficult that they advised him to do nothing at all, that is, not to risk any attempt. He came to me by chance one day whilst another dentist was with me. We both examined his mouth with much attention. Now, as this dentist was my elder, and I believed him to have more experience than I had, I begged him to give me his opinion as to the best method to follow in this case, in order to insure success. Whether it be that he would not give me advice, or that he was not in a position to be able to do so, the fact is that his answer was not such as I could have wished. I, therefore, felt myself obliged to tell him that I hoped to put this gentleman's teeth in order within three or four days. My colleague was not aware that this could be done so quickly; urged by curiosity, he returned when the time I had indicated had elapsed and found, not without surprise, M. Morin's teeth reduced to perfect order!"

"Several years ago the wife of M. Gosset, Reviseur des Comptes, sent for me to examine the teeth of her daughter, then twelve years of age. I found the lateral incisor on the left side of the lower jaw strongly inclined toward the palate in such a manner as to constitute a real disfigurement. Interrogated by the mother as to the possibility of remedying this, I replied that it could easily be done in eight or ten days, with the method of threads, if the young girl were only sent every day to my house. As, however, the young lady received instructions from several masters who came to her house each day, my proposal was not accepted, in order not to distract her from her studies. This induced me to say to the mother that, if she were willing, I would put the crooked tooth into its natural position in a few minutes. Surprised at so short a time being demanded for the operation, she consented to my performing it immediately. Making use of the file, I began by separating the tooth from the neighboring ones which pressed upon it, slightly diminishing the space it ought to have occupied. This done, I straightened the tooth with the pelican, placing it in its natural position, to

the great astonishment of the girl's mother and of other persons present, who told me they had many times seen similar corrections that had been carried out by the late M. Carmeline and others, never, however, with this method or in so short a time. As soon as I had reduced the tooth to its normal position I fixed it to those next to it by means of a common thread, which I left there eight days; and during that time I made the young girl rinse her mouth four or five times a day with an astringent mouth wash. After the tooth had become firm, it would not have been suspected that it had ever been out of its normal position." "When a tooth irregularly placed in the mouth cannot be straightened by any of those means," to which he alluded, "and occasions damage or inconvenience or constitutes a deformity,

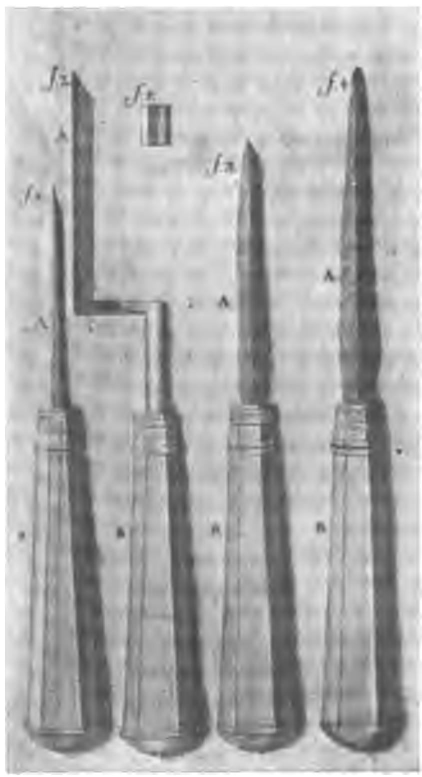


Fig. 4.—Dental files used by Fauchard. (5) Small wedge inserted between teeth in order to prevent the tooth from moving.

the sole remedy is its removal." He seldom had recourse to extraction and urges the necessity of attention to the temporary teeth. In speaking of extraction of the teeth, Fauchard begins by saying that the milk teeth, although destined to be shed, should never be extracted, except in cases of absolute necessity, as, for instance, when decayed, they give rise to intolerable pain. "The alveoli of the infantile jaw are weak, whilst the roots of the deciduous teeth are sometimes firmer and more solid than one would believe, and hence it is that in extracting a milk tooth one runs the risk of injuring the alveolus and even of carrying away a portion of it altogether with the tooth, not to speak of the danger of damaging or even destroying the germ

of the permanent tooth lying below." "Besides", Fauchard adds, "there are sometimes deciduous teeth that are never shed and never renewed. One must therefore, defer drawing children's teeth as long as possible unless they are loose. When, however, intolerance of pain or a caries endangering the integrity of the neighboring teeth oblige one to rescue without delay to extraction, one should carry out the operation with prudence and judgment, so as to avoid the dangers alluded to." "It sometimes happens", says Fauchard, "that one finds in children a crooked tooth by the side of a straight one; in these cases ignorant tooth drawers have often been known to remove the crooked (permanent) tooth, and to leave the straight, viz., the deciduous one, which afterward falls of itself, the individual thus remaining deprived of one of his teeth for the rest of his life. The rule to be observed in order

Fig. 5.—Early dental drill (Fauchard).

to avoid a similar error is always to extract the older of the two teeth and to leave the one that has been cut more recently, which is easily recognized by its being ordinarily firmer in the socket and of a better color than the first."

Here the author inveighs against all the charlatans of his day who dared, without being dentists, to perform dental operations, and whose number, it would seem, was ever increasing, so much so that he is led to exclaim: "There will shortly be more dentists than persons affected with dental diseases!" In proof of this he relates the case of a cutler of Paris, who extracted the molar tooth of a young girl because black spots having appeared on it, he believed it to be decayed; but perceiving that he had only removed the crown (it was a deciduous tooth about to fall out), and thinking that he had broken the tooth, proceeded to extract the root, removing, in his gross ignorance, the permanent tooth on the point of coming through.

"When a tooth planted irregularly in the mouth cannot be straightened by any of those means to which he afterward alludes, and occasions damage or inconvenience or constitutes a deformity, the sole remedy is its removal."

Pyorrhea Alveolaris.[1] "There is yet another, of which I think no other author has yet had occasion to speak and which, without affecting the other parts of the body, attacks the gums, the alveoli and the teeth. Not only are softened, livid, prolonged and swollen gums affected by it but often those which are free from this vice are not exempt from the disease; it is to be recognized by rather white and sticky pus which can be made to come out of the gums by pressing the finger firmly from above downwards upon those of the lower jaw and from below upwards on those of the upper jaw.

"This pus often comes out from between the gums and the body of the alveoli and sometimes from between the alveoli and the roots of the teeth; which happens more frequently on the external surface of the jaws than upon the internal, and rather around the incisors and canines of the lower jaw, than about those of the upper, which are, however, more ordinarily afflicted with this trouble than the molar teeth."

"We can refer the cause of this disease to repture or disunion of the capillaries produced by degeneration of the fluids which circulate through them. These fluids which have extravasated into the intermediary spaces or in the neighborhood of the same vessels which they have eroded, or burst, always tend to ferment or break down, forming little lesions more or less fistulous between the gums and the body of the alveoli, or between the alveoli and the root of the teeth. From this source is derived the purulent matter which is seen to issue from between the teeth and the borders of the gums, especially when the finger is pressed against them."

"The singular effect which I have observed is that those who have treated this disease by internal remedies whether anti-scorbutic or otherwise never succeed in curing them; which might give rise to the opinion that the disease does not come from an internal or systemic source, but from what is due to a local or accidental cause occasioned by the teeth. To assure myself of this, I have noticed that wherever teeth have been lost from this disease, the alveoli and their gums become so well reunited, cicatrised and consolidated, that no more pus comes out of them.

"I should conclude from what I have just said that this disease cannot be radically cured until the affected teeth are out of the mouth. We can, nevertheless, prevent this loss by the following means, which are to keep the teeth very clean, to lance the gums when necessary, to rub vigorously each day with the end of a finger dipped into some astringent, desicative or anti-scorbutic wash, such as I have described on pages 91 to 92 of the present volume. It is also necessary to cleanse the mouth well after each meal with a little water and wine mixed together, and to be careful to bear down firmly with the finger upon the gums in rubbing them, in order to expel the pus, which, without this expedient, will decay them, and eat away the alveoli so that the teeth will become loosened and will finally drop out from lack of support."

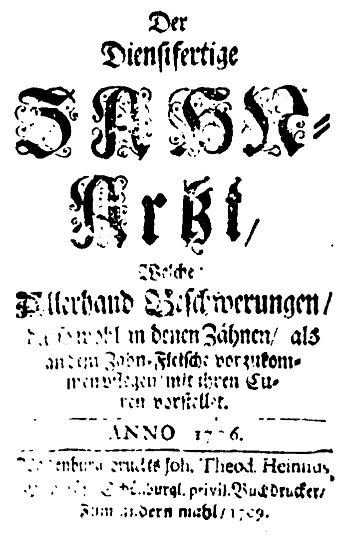
I have dealt at such length upon the work of Fauchard because his

1. Fauchard, Pierre: Le Chirurgien dentiste, 2nd ed. Par., 1746, v. I, pp. 275-278, by F. H. Garrison, Washington, D. C.

books mark a distinct epoch in the progress of dentistry and orthodontia. He gave to dentistry the first accurate description of pyorrhea alveolaris, to orthodontia the mechanical principle of the expansion arch. Through the publication of his experiences and methods a new era began in dental science and resulted in an abundance of publications in France during the remainder of the century.

A. Geraudly, in 1737, wrote an excellent treatise on the diseases of the teeth and the method of preserving and keeping them white. He clearly demonstrates that the shedding of the deciduous teeth is brought about by the pressure exercised upon them by the germs of the permanent teeth.

M. Bunon in his work[2] published in 1743, reviews the work of previous authors and is the first to mention "orthopedic" in connection with dentistry.



Der
Dienstfertige
Zahn-
Artzt,
[illegible]
Allerhand Beschwerungen /
[illegible] in denen Zähnen / als
[illegible] vorzukom-
[illegible] mit ihren Cu-
ren vorstellet.
ANNO 17[illegible]6.
[illegible] Joh. Theod. Heinius,
[illegible] privil. Buchdrucker /
[illegible] mahl / 1709.

Fig. 6.—Title page of one of the early works pertaining to dentistry (1706).

"One of the important questions studied by Bunon concerns the hygiene to be observed in order to obtain the development of a good dentition. On this question he rightly established the principle that hygiene and dental prophylaxis should begin from the period of the formation of the milk teeth. He worked on this principle with rigorous logic, and finished by tracing the hygiene of the mother during pregnancy of the woman be she mother or nurse during the nursing period and of the nursling as well."

"As to the accidents of first dentition Bunon sets forth a highly scientific opinion, fully coinciding with the ideas of modern writers, that is, that dentition is not the sole cause, nor even the principal cause, of such accidents but simply a co-operating cause. He made the observation that in healthy infants, children of healthy parents and nursed by healthy women, the time of teething is gotten over without difficulty while serious accidents occur

2. Bunon, M.: Essai sur les Maladies desdentes particulieres de l' auteur de l' Orthopedie. Paris, 1743.

frequently in weak and sickly children brought up and nourished according to unhygienic principles, or born, as not often happens, with special hereditary predispositions."

"One of Bunon's merits is that of having attributed to the first teeth all the importance they have, and of having insisted on the necessity of attentively curing their maladies. He also drew attention to the dangers that may result from the eventual persistence of the first teeth at the epoch of second dentition, or from the persistence of their roots after the destruction of the crown by caries. These roots, he says, by their contact with the neighboring permanent teeth may infect them and cause them to decay."

Bunon's researches in the development of the teeth enabled him to describe precisely the position that the various teeth of the second dentition occupy in the jaw with regard to the milk teeth before these are shed.

Bunon speaks at length of erosion of the teeth, and declares himself to be the discoverer of this disease, which destroys the enamel of the teeth before their eruption. The first molars, the canines, and the incisors are much more frequently damaged and affected by it than the other teeth. According to Bunon, it is generally due to measles, smallpox, malignant fevers, or scurvy, when children are subject to these maladies during dentition, and more especially during the first dentition. He is of the opinion that erosion not only causes caries, but may be considered as being the origin of the greater part of dental affections.

This author distinguishes three principal kinds of dental tartar, the black, the pale yellow, and the brownish-yellow; he admits, however, two other kinds that are less frequent, that is, the red tartar and the green.

In 1742 *Joseph Hurlock*, surgeon, published his "*Treatise upon Dentition, or the Breeding of Teeth in Children.*" In it he describes the many ailments that infants are subjected to during the period of dentition, and enumerates many of the forms of treatment advocated by the ancients. The major part of the book, however, is devoted to the practice of lancing the gums over erupting teeth. He reports in quaint language twenty cases in which he claims to have greatly benefited by this treatment infants who were suffering from a variety of disorders, including smallpox, measles and scarlatina.

Mouton in 1746 published the first work on mechanical dentistry, in which he devotes some little space to malocclusion. His methods for the most part correspond with those of Fauchard, although he had recourse to gold crowns, making use of them on the front as well as the back teeth.

A. Tolver (1752), in "*A Treatise on the Teeth,*" describes how the teeth receive the nerves and vessels at the orifices of their roots and how these were frequently shown to the common people, by the ignorant among the tooth drawers, as the worms which would soon have devoured the whole tooth had they not been skilfully removed. He emphasizes the "necessity of the sound teeth for health in masticating food and mixing it with the saliva." He also points out to men the dangers of hasty feeding. All kinds of sweet meats, and sugar, he says, contribute very much to the destruction of the teeth, because their gluey juices stick to the teeth; besides, sugars are of an acid, penetrant and corrosive nature. Those who love sugar and use it

much, rarely have good teeth. He is opposed to scaling the teeth, as it lays bare the necks of the teeth.

Bartholeomo Ruspini, in 1750 says, "Some writers were formerly of the opinion, that men had thirty-two teeth, and women twenty-eight; but inspection may plainly evince the absurdity of this notion."

"All of the teeth that exceed those of thirty-two may be reckoned as supernumerary, they generally push out between the incisors or fore teeth of the upper jaw; and in such case the incisors are increased in their numbers."

On the generation of teeth, he says: "Nature, in forming these bones seems to deviate entirely from those laws that she has established in the production of all other bodies, and to choose a peculiar uncommon method in this generation."

"The greatest part of natural productions have their beginning in their roots; but a tooth, on the contrary, does not begin to form its roots till the body is perfectly finished. The first substance that begins to appear in this body is not the internal part, as one would imagine, but the external one, the fartherest from the root, and what is called enamel. This substance in its beginning, is nothing but a mucus, soft paste, which acquires insensibly so much firmness, that it becomes at last a bony part, and excells all other bones (as we have shown in its proper place) in point of hardness and whiteness. When once this scale or bony coat is formed, the tooth assumes directly a proper figure, and its inward part begins to be filled."

"It is sometimes necessary to draw those teeth that lie across, or ride upon one another (a very disagreeable sight), in order to give a more exact and uniform arrangement to the rest. This defect of order in the canine and incisors in general, proceeds from an extreme narrowness of the jaws. But the operator must be very circumspect in examining every circumstance relative to the tooth; and socket, before he draws a milk-tooth; and if a part of the socket should be broken and give way, the second tooth will always come out in an irregular manner."

"*Philip Pfaff*, dentist to Frederick the Great, King of Prussia, was the first among the Germans who wrote a real treatise on dentistry. His book contains, the anatomical and physiological notions relative to the teeth, as well as all that belongs to dental pathology, therapy, and prosthesis. Gingival abscesses as well as fistulæ of the maxillary region almost always owe their origin, says Pfaff, to decayed teeth; and can, therefore, in general, not be cured except by the extraction of these teeth."

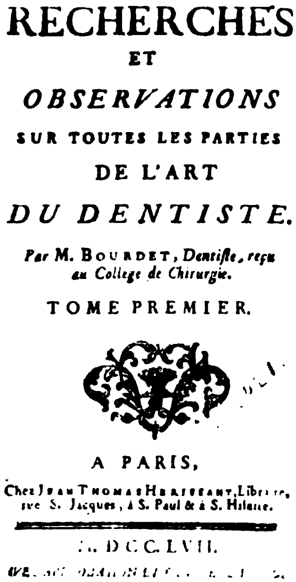
The prosthetic methods described by this author are, for the most part, identical with those of Fauchard and the other French dentists already mentioned. As to the materials used for prosthesis at different periods, Pfaff mentions, besides ivory, bone, hippopotamus tusk, teeth of sea cow, and human teeth, also teeth made of silver, or mother of pearl, and even of copper enamelled.

The chief merit one must concede to Philip Pfaff is that of having been the first to make use of plaster models. The casts of an entire jaw were taken by Pfaff in two pieces, one of the right half of the jaw, and the other of the left; which were then reunited, and one thus avoided spoiling the cast in removing it from the mouth.

Another great merit of Philip Pfaff is that of having first carried out the capping of an exposed dental pulp, previous to stopping a tooth.

Bourdet, dentist to the king, an eminent writer on dental art, published in 1757 the best work since Fauchard. In it he condemned as harmful the use of such things as bone rings and other hard substances people are in the habit of putting in the mouths of children. He carried the use of metal strips a step further than Fauchard.

"When the canines and incisors of the lower jaw protrude against the lip, the deformity may be corrected by the use of strips of plate. To put the upper teeth in their proper anterior position, and to draw back the lower ones, two semi-circular strips must be made, which surround the teeth from the second molar on one side to the same tooth on the other side. Each strip should be pierced with twenty small holes, which, when the device is



RECHERCHES
ET
OBSERVATIONS
SUR TOUTES LES PARTIES
DE L'ART
DU DENTISTE.
Par M. BOURDET, Dentiste, reçu au College de Chirurgie.
TOME PREMIER.
A PARIS,
Chez JEAN THOMAS HERISSANT, Libraire, rue S. Jacques, à S. Paul & à S. Hilaire.
M. DCC. LVII.

Fig. 7.—Title page, Bourdet (1757)

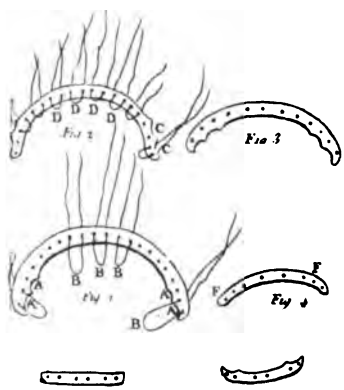


Fig. 8.—Bourdet's appliances (1757).

applied, ought to be exactly opposite the teeth which are to be placed in order, so that the thread caught in the two holes which serve for each tooth may draw it toward the strip. The strip of plate for the upper jaw will, of course, be larger than that for the lower, and it will be placed outside, toward the lip; while that for the lower jaw will be placed inside the dental arch toward the tongue. As to the lower strip, each thread will form a loop on the strip's posterior face, and the ends which pass between all the teeth will fall outside and be tied each on its own tooth!"

Following this, Bourdet gives a minute detailed description of the tying of each thread, which is unnecessary to quote here. He then continues as follows:

"Nearly the same process is followed with the strip of plate on the lower jaw. The threads are passed in and out in the same manner and then tied

and knotted on the teeth. These strings should be removed and retightened twice a week, until the teeth have resumed their proper position—that is to say, until the teeth of the upper jaw are drawn forward, so that no part of them is hidden behind those of the lower jaw. When this operation is properly performed—the improvement is so great that the patient is hardly recognizable."

"Strips of plate ought to be of gold,—never silver, which turns black in the mouth."

"Sometimes, when the permanent canine comes forth, it has not room enough, and therefore grows outward. In this case Bourdet extracts the first premolar; the canine then advances gradually of itself toward the space left by the extracted tooth until it occupies its place exactly. He also counsels the extraction of the first premolar on the opposite side of the jaw, in order to preserve the perfect symmetry of the dental arch on both sides. When the arch formed by the jaws is too large and of an ugly appearance, Bourdet advises extracting the first upper and lower premolars, so that the dental arches may acquire a more regular form. In cases in which the defect of form exists only in the lower jaw, that is, in children who have protruding chins, Bourdet corrects this deformity by extracting the first lower molars shortly after their eruption, that is, toward seven years of age. In this manner, says the author, the lower jaw grows smaller and the deformity disappears. The inventor of this method, as Bourdet himself tells us, was the dentist Capuron."

"Bourdet made prosthetic pieces, whose base, representing the gums and the alveoli, was made entirely of gold and covered over with flesh-colored enamel on the outside, so as to simulate the natural appearance of the gums; the teeth were adjusted into the artificial alveoli and fixed with small pins. At other times he made use of a single piece of hippopotamus tusk, in which he carved not only the base, but also the three back teeth on each side, whilst the ten front teeth were human teeth fixed to the base with rivets."

"One of Bourdet's principal merits is that of having brought artificial plates to perfection by fixing them not, as heretofore, to the opening of the palate or inside the nose, but by means of lateral clasps fitted to the teeth.

"In a special pamphlet, published in 1764, Bourdet treats of the diseases of Highmore's antrum. To facilitate the exit of pathological tumors from the sinus, after the Cowper operation, he introduced a small cannula, forked at one end, into the antrum, and fixed the two branches of the fork to the neighboring teeth by tying."

Jourdain was another eminent writer on dental matters, at this time. In 1759, Jourdain described in the *Journal de Medecine* an improved pelican and another instrument to be used for straightening teeth inclined inward. Two years later he published his treatise on the diseases of the antrum of Highmore, and on fractures and caries of the maxillary bone. After this, appeared his book on the formation of the teeth. He therein described with great accuracy the dental follicle from its first appearance to the moment of birth, following it throughout its evolution.

A. A. Brunner (1771). One of the most distinguished German dentists in the second half of the eighteenth century was Adam A. Brunner. "A milk tooth," says Brunner, "ought never to be extracted unless there be

manifested signs of the presence of the corresponding permanent tooth, or when it is painful or decayed. Badly grown teeth can often be put in order solely by the pressure of the fingers frequently repeated, but when this is not sufficient one must have recourse to waxed threads or to special contrivances."

Thos. Berdmore, dentist to George III, the first to receive an appointment as dentist to a royal family, was one of the earliest and foremost dentists in England. His work, "*A Treatise on the Disorders and Deformities of the Teeth*" published in 1786, marks the appearance of the first important English publication.

"Berdmore contributed to the progress of dentistry in England not only by his writings but also by imparting theoretical and practical instruction

Fig. 9.—Bourdet's forceps for extraction of teeth.

Adam Anton Brunners

Wundarztes, und Ihrer röm. k. k. apost. Majest. Zahnarzt's der Theresianischen Militar-Pflanzschule, wie auch der Herzoglich-Savoyischen Ritterakademie,

Abhandlung

von

der Hervorbrechung

der

Milchzähne.

Wien,

gedruckt und verlegt bey Joseph Kurzböck, k. k. illirisch- und orientalischen Hof- wie auch N. Oest. Landschafts- und Universitätsbuchdruckern.

1771.

Fig. 10.—Adam Anton Brunner (1771).

to many medical students desirous of practicing dental art as a specialty. One of these was Robert Wooffendale, who came to America in the year of 1766, and was the first dentist whose name is recorded here."

"In his work he thus describes what he thought to be his mechanism, but which was really Fauchard's."

Irregularities of the Teeth, and the Reduction of them by Ligature.—Irregularities of the teeth are extremely frequent, where none of the above mentioned precautions have been taken, and where the second as well as the first dentition has been neglected as a matter of no concern; it is often required therefore, to correct by art, what at first might easily have been prevented.

To bring the teeth which are ill set into beautiful order, at any time of life, is promised every day in the public papers, with the greatest assurance, by several people who profess themselves dentists; and I am afraid that there are enough people to believe such advertisements, and to accuse every man of ignorance, who should affirm that it is impossible. Yet, notwithstanding all this, I will freely own that I never have, nor even will attempt this ingenious practice upon grown people; for reasons which I shall assign, after having first shown the different methods of it.

The first is to pass a gold wire or silken ligature from the neighboring teeth or either side, in such a manner as to press upon that which stands out of the line, in a direction which shall tend to reduce it.

The second is to fix a thin, elastic gold plate, of the breadth of a watch-spring, on that side of the tooth which recedes most from the proper line, and then to fasten the ends of it to the teeth on either side, so that the bent of the spring may tend to press the irregular tooth back to its place. This, and the former contrivance, may be applied where one or more teeth incline inwards, as well as when they project externally.

The next method is not quite so gentle, and consists in breaking the teeth into order, by means of a strong pair of crooked pliers, after which the ligature is to be applied. The last is, to file them into order.

In advanced age, it is well known that the teeth are so deeply and firmly fixed in the substance of the jaw-bone, that it requires a considerable power to force them out of their places, and that none of the bones, at this period, will yield to slight, continued pressure, in the same manner as the tender, growing bones of children will do. But without a yielding of the bony sides of the sockets, or of the flinty substance of the teeth, how is it possible to bring a tooth which projects outward, or inclines to the inside into the proper line; or supposing this were feasible, if the pliant bones of children requires a considerable length of time to effect such alterations, what would be the time necessary on this occasion? If we may tell the truth, such notions belong to fancy not to practice; and such promises are founded on ignorance, or intended for deceit.

The same observations apply to the second method, or to those that pretend to have used the elastic plate successfully.

As to the third, it is such a treatment as need not be opposed; because it is not credible that any grown person is so easily persuaded, and so regardless of pain, as to submit to the trial. But supposing the case were otherwise, it is well known that a tooth in a grown person cannot admit of any considerable change of situation, without being raised out of the socket; so that whilst the operator brings it into the line on one hand, he raises it above the level on the other; he destroys its connections, exposes it to looseness, pain and decay, and makes it incapable of bearing the ordinary impression in chewing; an evil much greater than the total loss of a tooth.

As to filing the teeth into proper shape, size and order I know that it is practiced every day, and shall therefore consider it more at large, after I have first pointed out some instance where the reduction of the teeth is practicable and safe, and which serve as a pretext for the exaggerated accounts, and the incredible pretensions of those who promise to succeed at all times.

Between the seventh and twelfth year, whilst the teeth are growing, and the sockets are in a condition to yield, by degrees, to any constant pressure, if the edge of a tooth stands out of its proper direction, it may oftentimes be brought back, provided likewise that the projection of the tooth out of its required direction be not very considerable, and that the pressure do not fall solely on the two neighboring teeth; for it always should be divided by throwing a few turns of the wire or ligature over some of those that stand at a distance. The use of the elastic plate is more inconvenient to the patient, but not more effectual than this method; and the application of instruments, to force the teeth at once into order, is extremely dangerous at any age; since it is more likely to loosen them, and make them fall out, than to give regularity and beauty.

Of the Use and Abuse of Filing to Remove Irregularities of the Teeth.—There are many instances in which it is advisable and safe, as well as ornamental, to file the teeth; but as it is usually practised, nothing can be more prenicious.

Since it cannot be supposed that any man is so lost to shame and humanity, as to expose his patient to pain ana inconvenience during life, merely for the sake of a trifling fee, the

indiscriminate filing of teeth, so common at present, should be imputed only to ignorance. and may, I hope, be checked, by placing the subject in a clear light, and by drawing the line to distinguish where it may, and where it may not be practiced with safety.

1. In people far advanced in years, the teeth may be filed into order without any inconvenience; because the nerves are lost, the teeth can feel no pain in the operation, nor afterwards from cold, acids, or sweets, and because they are not then so much subject to caries or decay.

2. Where a tooth projects beyond the common level, and hinders the rest from meeting equally, or receives, on itself alone, all the pressure which should fall divided on a whole set, there, filing is necessary at any age, to remove the greater evil.

3. Filing is necessary and advisable to remove sharp points, occasioned by fracture or otherwise, which irritate and wound the lips and tongue; because, in this case, the bony part of the tooth is already exposed, and cutting off the sharp prominences cannot make it more liable to caries or pain than it would otherwise have been.

4. Where a tooth points obliquely against the tongue, or against the lips, as often happens on account of the resistance of the milk-teeth, it is necessary to round the edge by filing, to prevent its wounding the soft parts.

5. When the edges of the fore teeth are uncommonly sharp and thin, and therefore apt to splinter, it is very proper to file them down, to give them a more obtuse and durable edge.

6. Filing is likewise advisable to remove caries, to prepare a tooth for the reception of a new crown, and in a few similar cases, related in the second part of this treatise.

7. When the teeth stand irregularly, and are too broad to admit of being reduced to one uniform line, filing between them, to lessen their size, may be practised to a certain degree; but great care should be taken not to cut away the enamel totally, as is too often practised on this occasion.

If a man has no feeling, nor any other use for his teeth but for the ornament of his countenance, I should not limit the use of the file to these cases only. But since most people from infancy to middle-age, feel insufferable pain the very moment the file touches the bony substance; and since this pain must be very often repeatea, because each successive surface of the osseous substance must have some time to wither, ana lose a part of its sensibility, before it can admit of filing beyond a certain depth; since it happens, likewise, that the enamel once removed, is never regenerated, that a tooth in this naked state is for a long time affected with pain from the slightest impression of cold, acids, sweets, etc.: that it wears away quickly, and is very much subject to decay; I cannot join to support the common practice of indiscriminate filing; I think it should be confined to the cases above related, for I believe it is advisable in these only.

Hence it is, that I so frequently refuse to perform this ornamental operation for my patients, and that I have often advised young people, who have credulously listened to advertisements and promises of this kind, never to barter a sure and valuable blessing, irregular teeth may last healthy and unpained to the latest period of life, and the deformity in general is not very great, provided they are kept clean, white, and polished.

The cautions which are to be observed in filing, and the method of reducing the projecting teeth to one uniform edge, so that the upper and under rows may touch on at present; having through the whole, endeavored not to swell this work with descriptions which are only intelligible to operators, who ought to learn the mechanical part of this art from experience and not from books. I will not, however, conclude this chapter without observing that the people of this country, who practice on the teeth, are not quite so liberal in their promises, nor so fond of cutting and filing as the gentlemen who quit the continent for our sakes, and walk in a more exalted sphere, piquing themselves on the dignity of having served Counts and Marquises in the station of valets de chambre, and of having seen the art of filing practiced in twenty provinces.

The cause of supernumerary teeth or a double row of teeth is due to the fact that the milk-teeth are never shed, notwithstanding the fact that the permanent teeth appear. Irregularity of the teeth is due to the resistance offered the permanent by the temporary, which also occasions snaggled, rough and indented teeth.

CASE HISTORY.

By H. C. Pollock, D.D.S., St. Louis, Mo.

HISTORY.—Age 12. Classification (Class II, Div. 1). Full complement of teeth with well-developed and sharp cusps, with the exception of upper left first molar which was broken down with pulp lost.

Patient was examined three years previous to consulting orthodontist, by a rhinologist, who reported the passages free of any lymphoid tissue, subsequent to this examination on two separate occasions as to condition of the nasopharynx and each time it was reported clear. Further, marked distal occlusion does not exist in either parent or in any of his ancestors insofar as it is possible to obtain data on this point.

It is possible this case is of some interest on account of the lack of muscular function of the lips as the photographs clearly indicate, and belongs to that type of cases which some authors describe as "the action of the muscles

Fig. 1.

Fig. 2.

of the lips being abnormal the upper lip does not exert pressure upon the upper anterior teeth thus allowing them to protrude, the mouth is open and the lips parted, the lower lip drops back against the lower anterior teeth and the upper portion of the lower lip exerts pressure on the lingual surface of the upper anterior teeth. The constant irritation of the lip caused by contact with the upper teeth causes the lower lip to become thicker, which, acting as an elastic cushion, causes the upper teeth to protrude to a more marked degree." Another unusual point in this history is the several reports of a clear passage in the breathing space, as this type of case usually shows a history of adenoid vegetation complicated with the mouth-breathing.

The lips had never developed the muscular function; they had no muscular tone. At the time treatment was started the patient was unable to cover the teeth with the lips, partly on account of the lips not being sufficiently long to cover the abnormal space and no doubt also partly due to his inability to exert any muscular effort of the lips in closing them. The function of the orbicularis oris seemed to be practically nil,—the patient was unable to pucker the lips, even in the slightest degree as is done in an effort

to whistle. Both lips had developed to an abnormal size and shape as is indicated in Fig. 3.

Etiology.—Some writers who have made extensive researches in regard

Fig. 3.—Oct. 4, 1914.

Fig. 4.—Oct. 4, 1914.

Fig. 5.—Oct. 13, 1915.

Fig. 6.—Oct. 13, 1915.

to this type of development and writing from an orthodontic standpoint maintain this entire abnormal anatomical architecture to be a result of constant mouth-breathing during the developmental period and enhanced by the

resultant distal occlusion of the teeth. Others writing from the standpoint of oral surgery contend that nature has equipped this individual with an unusually short, underdeveloped mandible, with a short ramus, much the same as she equips some individuals with a short bony structure of the nose and others with a large framework of the nose, and having made a start the teeth are unable to engage normal occlusal relations at the proper period. In any event the development is progressive, and as soon as the teeth are mechanically placed in normal occlusion this region of the face soon assumes an entirely different relation to the bony structure. To mechanically shift the occlusion of the teeth and expand the dental arches, causing the bones about the maxillary region to assume greater size and different relations to each other, certainly gives results in these cases which are gratifying; but not all that is to be desired. The teeth must be allowed to fix themselves in their new position of normal occlusion and the pounding of the mandible against the maxilla in the masticating of food through the medium of the teeth must be exerted for months before we may expect the best balance of the face as a result of orthodontic procedure.

Treatment.—Expansion arches of .030 tungsten wire were clamped to the first molar teeth and the usual procedure of the Baker anchorage resorted to. The retainers being used are the Angle pin tube appliance on the lower arch, as it has been observed the best balance is obtained and development of the mandible encouraged by the prolonged application of these appliances where there is required a considerable amount of bone development.

Sterilization of Dental Instruments.

THE possibility of the transmission of disease through the medium of dental instruments has probably been considered by every occupant of the dentist's chair. It constitutes one of the fears with which a patient is possessed the moment he adjusts himself for his period of treatment. Authoritative instances of the conveyance of contagion in this manner are extremely rare, its frequency not being determinable, although few will deny the possibilities of occurrences of this character.

The list of organisms which may contaminate dental instruments is formidable, but this does not mean that the diseases of which they are the causative factors necessarily ensue if they are accidentally carried into the mouth. Their presence upon dental instruments is, however, an indication of what the surgeons call poor technic. In surgery, poor technic is usually attended with disastrous results, but in dentistry errors of this character may produce no ill effects. In spite of this relative freedom from danger, dentists are determined that their methods shall equal the highest standards.

Cleanliness should be the primary consideration in all dental operations. The white coat of the operator represents more than confort; it is the symbol of neatness. The dentist who works with unclean instruments, who provides soiled linen, or who places a common drinking glass before his patient, should be judged accordingly. Fortunately the members of the profession who do these things are criticized and suffer from loss of patronage, so that there is a strong tendency on the part of the dentists to maintain their surroundings above reproach. With the sterilization of instruments some carelessness may manifest itself, partly owing to the fact that many instruments are injured by such processes, are too complicated to be treated in this manner, or that the public is not competent to detect errors of technic. However, the public is rapidly learning the value of aseptic methods and the proper equipment is now found in nearly all dental offices.

Thorough studies of the sterilization process have recently been made for dentists by the United States Public Health Service, at the request of various dental associations throughout the country, and in a recent publication of that Service detailed information will be found as to the accepted methods for sterilization of all dental instruments.—*Boston Med. and Surg. Journal.*

CURRENT ORTHODONTIC LITERATURE

EDITED BY H. C. POLLOCK, D.D.S.

Other Points in Malocclusion.

IN AN admirable paper entitled "A Consideration of the Problems Involved in Removable Bridgework" (*Dental Review*, February, 1916), Doctor Karl G. Knoche, Chicago, takes up the question of malocclusion and maintains that with its resultant undue pressure in an abnormal direction on the peridental membrane plays the most important part in the development of pyorrhea conditions. He points out that the loss of a single tooth, the failure to properly separate teeth resulting in the loss of normal contact, and many other things brought about a malocclusion that brought about acute pyorrhea which could never be successfully treated without the restoration of the proper occlusion.

Malocclusion, he says, means any break in the continuity of the dental arches, for just so soon as we have a break we have an abnormal condition and a malocclusion. This break may be a cavity allowing the tooth adjacent to it to move forward and we then lose normal contact with the resultant pinching out of the interproximal tissues and a loss of what Dr. G. V. Black so clearly calls the alveolor crest. Unless the teeth are properly separated and a filling then inserted to restore the normal contour of the tooth involved we simply perpetuate the abnormal condition and we have ultimately a loss of interproximal tissue and so on. This break may be the loss of a single tooth allowing the teeth to tip and so producing stress in an abnormal direction on the peridental membrane and then the inevitable follows.

This abnormality may be an interference with the normal exercise necessary to maintain the health of the teeth. We find teeth under too great stress or too little. In the first place an inflammation is set up by the irritation and in the second we have a lowered vitality and lack of resistance due to improper stimulation. This break in the normality of the dental arches may be in the nature of uneven wear of teeth which must mean uneven stresses. This malocclusion may so often be the result of apparently well-made fillings and inlays. The presence of fillings of any sort which are not perfect reproductions of the occlusal surfaces are sure to produce malocclusion simply because the flat surfaced inlay provides a fine surface for the patient to slide around with no place to lock and maintain the balance. One of the greatest faults found with fillings of all kinds is the usual total lack of the marginal ridges. They are usually provided with planes inclining toward the contact point affording every opportunity for food, to pack against the gum septum.

Dr. Knoche states that his one great objection to amalgam is the fact that for some time he has believed that many men shorten the bite somewhat every time they insert an amalgam filling by excessive trimming to protect the still plastic material. The nature of the material influences the operator to trim until perfect occlusion is lost.

One of the most valuable contributions to dentistry is Dr. J. Lowe Young's work on the correct occlusal restoration. He arrives at his deductions not from an operative experience, but in his treatment of mouths as an orthodontist. He found that his own results were unsatisfactory in mouths that have had poor occlusion restoration. His work brings the lesson that by placing poorly made occlusal restorations in the pits and fissures of children's teeth, we may bring about a malocclusion that in after life results in the worst kind of pyorrhea.

As to the results obtained by a restoration of the normal occlusion in post-pyorrhea treatment, Dr. Knoche says that they are often startling, and that he has known many cases in which the instrumentation was simply palliative and of temporary benefit until the malocclusion was corrected and the teeth stimulated or rested, as the case might be. So this subject becomes one of vast import and he is convinced that general practitioners, pyorrhea and prophylaxis workers, or bridge workers, need a clear knowledge of dental anatomy and especially that portion that deals with occlusion and its abnormalities even to a greater degree than does the orthodontist, if the public is to be served in an intelligent and beneficial way.

Book Reviews.

A Text Book of Operative Dentistry.—By various authors, edited by C. N. Johnson, M.A., L,D.S., D.D.S., Professor of Operative Dentistry in the Chicago College of Dental Surgery, Editor of the *Dental Review.* Third, edition, revised and enlarged, with 805 illustrations. Published by P. Blakiston's Son & Co., Philadelphia. Cloth binding, $6.00 net.

No book devoted to the science of dentistry has had a greater sale than Johnson's Operative Dentistry, which is now in its third edition. The book, written by various authors, deals with the field of operative dentistry in a very complete manner. Probably no better authorities could have been obtained than those who collaborated with Dr. Johnson in writing the various chapters. Of interest to men engaged in the practice of orthodontia, we might call attention to Chapters I and II, edited by Dr. C. R. Turner. The illustrations used in these chapters, some of which are original, especially of the dental anatomy, are very accurate and instructive, while a great many of those devoted to the subject of histology have been gathered from the writings of various authors, and are very beautiful. Chapter XXXIII, on the subject of orthodontia, is edited by Dr. Herbert A. Pullen, of Buffalo, New York. It would be very hard indeed to find anyone in the dental profession better suited than Dr. Pullen to write a chapter on orthodontia such as is found in Johnson's Operative Dentistry. The entire subject of orthodontia is covered in a very satisfactory manner, a large number of original illustrations are used, some of which show special apparatus, appliances and instruments, as designed by Dr. Pullen. It would be well worth while for anyone interested in the subject of orthodontia to purchase Johnson's Operative

Dentistry, if for no other reason than simply to obtain the chapter written by Dr. Pullen. We believe the third edition of the book will occupy the same prominent position in dental literature that the other editions have maintained.

Orthopedic Surgery.—By Edward H. Bradford, M. D., consulting Surgeon for the Children's Hospital, Boston, and to the Boston City Hospital, Professor of Orthopedic Surgery Emertus in Harvard University, and Robert W. Lovett, M.D., Professor of Orthopedic Surgery at the Harvard University, Surgeon to the Children's Hospital, Boston, Surgeon-in-chief to the Massachusett's Hospital School. Fifth edition, profusely illustrated. Published by William Wood & Company, New York.

In the past few months several papers have appeared in orthodontic literature upon the general health of children as affecting the development of the teeth in childhood and such other factors as produce malocclusion. Treatment of malocclusion, dealing with the structures surrounding the teeth is, in reality, a certain part or a specialty of orthopedic surgery. Several years ago, Dr. Case coined the term "facial orthopedia," because of the similarity which existed in the treatment of the teeth and jaws to the correction of deformities of bone in other parts of the body. Bearing this in mind, those engaged in the practice of orthodontia would do well to pay more attention to the literature of orthopedic surgery. This work by Drs. Bradford and Lovett especially contains a great many points of interest to the orthodontist. Tuberculosis of the bones and joints, tuberculosis of the spine, and tubercular disease of the hip, as well as tubercular disease of the ankle and other joints, are considered in a scientific and interesting manner. The pathology of these cases, as it affects the bones, is of especial interest to those engaged in the treatment of malocclusion. The section dealing with the deformity of rickets is of so much value that any one engaged in the practice of orthodontia can ill afford to miss the reading of this chapter, dealing, as it does, with the general causes and pathology of rickets. There is no question in our minds but that a large number of malocclusions have rickets as a predisposing, if not the exciting cause. This work describes rickets in adolescence, or late rickets, as a disease which affects the person about the age of puberty, which, in our minds, is the predisposing cause of the largest number of malocclusions that we have to treat, and probably the predisposing factor to a great many of the failures which we encounter during retention. The various deformities, which are shown accompanying rickets, can not help but impress one with the fact that deformities of the mandible and the maxilla are very early produced by such a disease. The work is of especial value, of course, to orthopedic surgeons, but even to orthodontists it presents so many interesting and valuable points that we believe it would be a valuable addition to the library of any one engaged in this specialty.

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EDITORIALS

The Relation of Oral Surgery to Orthodontia.

CLOSELY related to the practice of dentistry are two specialties, oral surgery and orthodontia, both of which have more or less relation to the practice of medicine and are very closely related to each other. Orthodontia has been defined as that science which pertains to the correction of malocclusion of the teeth, while oral surgery deals with the correction of pathological conditions associated with the oral cavity, and also with the correction of certain congenital and acquired deformities. Orthodontia has also been defined as dentofacial orthopedia, and may therefore be said to be orthopedic surgery of the face and closely related to oral surgery. There is no question that the correction of malocclusion of the teeth will prevent and correct a large number of facial deformities, which, of course, are the result of acquired conditions that produce abnormal development. As has, however, been stated by Drs. Blair and Federspiel, orthodontia has its limitations, and there are cases where facial deformities that are the result of acquired conditions should be corrected by operative surgery. Overdeveloped mandibles have also been improved by plastic surgery by operating in such a manner as to produce a shortening of the mandible. Orthodontia is based on the philosophy of proper occlusion, and in orthodontic treatment we are forced to obtain improvement by a method that will produce a gradual development

of the parts and that will tend to conserve the tissue rather than to destroy it. In times past a great deal of oral surgery has been done, not so much with the idea of preserving tissue as with the object of getting certain definite results, and these results sometimes present very little improvement over the original condition. It is a well-known fact that most of the successful oral surgeons are those who have an intimate knowledge of dentistry, and it is equally true that the greatest success in oral surgery is obtained by those who have a definite knowledge of orthodontia. There are many cases in which the greatest benefit can be obtained for the individual by a combination of orthodontia and oral surgery—in other words, by a combination of orthodontia and orthopedic and operative treatment. We have seen many results of operations for cleft palates and harelip where the operations were performed solely with the idea of closing the cleft, without paying any attention to the relation of the superior maxillary to the nasal cavity. The dental arch had been entirely ignored, the sole object having been the closure of the cleft. We have seen persons of quite an advanced age with cleft palate and harelip whose condition, in our opinion, could have been greatly improved with the proper operative treatment, but they had refused to be operated on because they had learned of some baneful result that had been produced by some surgeons who operated simply with the idea of closing the cleft. If the operator has a knowledge of the proper occlusion of the teeth, the relation of the alveolar process, and the necessity of having the alveolar process establish the dental arch, there will not be so many imperfect results as in times past. With a large number of cleft palate and harelip cases the trouble is not so much the absence of structure which produces the cleft, but there has been a misplacement and an abnormal development. Very often the premaxillary bone is displaced, and, if gradually worked into position, as has been suggested by Dr. Federspiel, a much better result can be obtained by combining orthodontic treatment and oral surgery than can be obtained only by the latter method. We believe that in the future the successful oral surgeons will be the orthodontists. The technic described by Dr. Federspiel can be successfully practiced only by the man who has a knowledge of orthodontia, and who is capable of adjusting appliances in such a manner as to hold the parts in position, depending on the teeth to give support to those parts, providing, of course, that the patient has erupted teeth. In every operation for cleft palate in young persons before the teeth have erupted, the operator must have a knowledge of what may be expected to develop in the future, so that he will be able to establish or close the cleft in such a manner that it will be possible for the teeth to erupt approximately in normal positions. He must also close the cleft in such a manner as to allow a closure of the cleft of the lip and maintain the normal function of the lip, realizing the necessity of normal muscular pressure in the development of the face and of the dental apparatus. We know from experience that the practice of orthodontia has an intimate relation with the medical profession, but it will require considerable education of the dental and medical professions before we will succeed in making the physician, dentist, and oral surgeon realize that a knowledge of orthodontia and of the occlusion of the teeth and forces of occlusion is necessary in order that the patient may receive the best possible results from oral surgical operations. Orthodontia is a much newer

science than oral surgery, and it will necessarily require some effort to make a man who has been doing oral surgery with the idea of simply closing the cleft realize that there is a better procedure, that there is a technic far superior and that there is a method by which far better results can be obtained by taking advantage of the knowledge which almost any orthodontist possesses. We believe that the successful oral surgeon in the future will be the man who has both medical and dental training, who is familiar with general surgery and pathology, and who knows enough about orthodontia and oral surgery to combine the two in his work and thereby render greater benefit to his patients.

Malocclusions in Dental Clinics.

DURING the past few years endowments have been placed by philanthropic men for the purpose of establishing free dental clinics in large cities for the worthy poor. There is no question that the establishment of free dental clinics, if properly conducted, will be a great benefit to the human family. There is also, however, no question that the establishment of such free dental clinics, with unlimited dental service to whoever may apply, will do corresponding harm to the public and the dental profession. Nothing else lowers the value of an article so much as the fact that it can be obtained free—to establish a condition whereby the public fails to place a proper value on a certain article or service. It is true that there are a large number of people in a city of any considerable size who cannot afford dental treatment if they are forced to pay for it. There is, however, a great danger of creating conditions similar to those that exist in large hospitals for the sick. Anyone who has been associated with the free medical clinics realizes the difficulties encountered in keeping the unworthy out of the medical clinic. It frequently occurs that a person who is amply able to pay for medical treatment will apply at some hospital for free treatment. It may happen that the management of the particular hospital to which such application has been made obtains information which causes the applicant to be refused treatment on the ground that he is able to pay for medical services, and cannot be allowed to crowd out some one who is not able to pay. This does not, however, always remedy the matter, as the patient will probably go to some other medical clinic and receive the services he is determined to obtain. This condition demands some means whereby a free dental clinic can be so conducted that the unworthy are prevented from practicing such deception. Many arguments have been advanced for the establishment of a free dental clinic because the dental colleges were unable to take care of the worthy poor, or were not inclined to take such care. It has, however, been our observation that any person can receive treatment at the dental college clinics without pay if the applicant can show that he is worthy and is unable to pay even the small amount for the material.

Now, in regard to orthodontic treatment in the free dental clinic, we have another problem that is more important than the usual free dental services. While there probably is no other one treatment that will do an in-

dividual as much good as to have a bad case of malocclusion corrected, still the correction of malocclusion is not absolutely necessary to save the life of the individual. It may be necessary for the health of the individual, but, so far as life and death are concerned, malocclusion is not to be compared to a necessary major surgical operation; which must be performed at a particular time in order to save the patient. The time required for orthodontic treatment extends over quite a number of years, and the age limit is gradually being extended. We mention this because it may be that when a patient is 7 years of age the parents may be unable to pay for orthodontic treatment, but by the time the patient is 13 or 14 years old they may be amply able to pay for such services. We have known of persons desiring to receive treatment in a dental clinic, claiming that they could not pay for orthodontic services, when, as a matter of fact, they owned a home and had an automobile. Some of these applicants claimed they could not pay for orthodontic treatment because they were paying for a home, when they probably had more worldly goods than many orthodontists. We have had experience for a number of years in dental college clinics and clinics in post-graduate schools, and have become familiar with the class of people who seek orthodontic services. We have been told by teachers in large dental schools in other cities that people are continually applying at the dental clinic for orthodontic services who are well able to pay for treatment, but, because proper treatment is, as a rule, a matter of several hundred dollars, they consider that, if they can get the work done in a dental clinic for $50.00 or $60.00, or about the cost of the applicances, they are making that much money. Do not understand us to say that we are opposed to free orthodontic services or to orthodontic clinics for the worthy poor, but we certainly are opposed to the promiscuous admission of patients who apply for orthodontic services as is practiced in some dental schools.

We are of the opinion that if at 12 or 13 years of age a malocclusion is very extensive, producing a facial deformity, and the patient cannot pay for having the case treated, and there is very little prospect that he will be able to pay 4 or 5 years from that time, we certainly feel that an effort should be made to correct that deformity, but we do not think the work should be entirely gratuitous, for our experience has been that cases which have been treated free of all cost are usually failures. In an experience extending over 15 years in orthodontic clinic we have yet to see a case of malocclusion begun entirely gratuitously that was ever carried to completion. The reason for this lack of completion is that the treatment of the malocclusion usually extends over a number of years in order to attain permanent results. Incomplete corrections that will not be permanent because the teeth are not yet in their proper positions may satisfy the patient and he will cease keeping regular appointments, or may fail to come at all, as he has an improved result, without any outlay, and he feels that the longer he comes the more it will cost him in time. In orthodontic clinics the patient should pay for the services according to his ability, that is, if $10.00 is a proper charge, he should pay $10.00, or such proportionate amount as will be large enough to cause him to keep his appointments. Unregulated charity has done much harm. We have been told by social workers that unregulated charity brings evil in many instances and that in the course of a year considerable of the money

that is given to charity is practically wasted. Some social workers claim that not more than 10 per cent of the amount contributed to charity is effectively applied for the purpose intended. We believe that if this is true, a similar condition may prevail in free dental clinics, especially in regard to the treatment of malocclusions. In order to make people realize the value of orthodontic services, and in order to have patients keep their appointments, so that the contemplated benefit can be accomplished, it is necessary that they pay something. One of the prime advantages of a dental, medical, or orthodontic clinic is the factor of instruction for the profession. No practitioner or student would care to be connected with an orthodontic clinic unless it be possible for him to finish his cases, so that he could obtain complete data as to the result of the treatment and the value of the different appliances, as he would not maintain interest in a clinic very long if he simply started the cases and could not carry them to completion. An orthodontic clinic should, therefore, to be of any value to operator or patient, be conducted in such a manner as to compel the patient to have the treatment carried to completion. We say again that nothing else will be so effective in compelling a patient to continue treatments as to be obliged to pay a fee, which should be large enough to have a commercial value.

We again caution those in the dental profession who are advocating free dental and orthodontic clinics that it is possible for such free clinics to be productive of a great deal of harm if they are not properly conducted, and we believe that at the present time free orthodontic services to the public, even in an endowed clinic, is not advisable for the reasons mentioned. We have seen patients who needed orthodontic treatment and needed it badly, but we have yet to see one of those cases, under our observation, carried to completion unless the patient was compelled to pay for the services.

Report on Classification of Malocclusion in the Forsyth Dental Infirmary Clinic.

THE records of classification of the first 500 cases of malocclusion examined in the Forsyth Infirmary (Angle classification) has been reported as follows:

Class I	339
Calss II	111
Class III	29
Normal	21
	500

The divisions and subdivisions of Class II and III are not reported. The report also states that the Morse chart was not used in the majority of cases, but in any instance where there was a question of doubt as to the proper classification the case was not classified.

The International Journal of Orthodontia

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ORIGINAL ARTICLES

FACE FACTS

A Clinical Study of Dento-Facial Deformities

BY B. E. LISCHER, D.M.D., ST. LOUIS.

Professor of Orthodontics, Washington University Dental School.

NUMEROUS, accurate investigations have conclusively demonstrated that in many communities 97 percent of the population is affected by decay of the teeth. In fact "it is now universally admitted that dental caries is the most prevalent of all diseases, that its numerical incidence is largely proportionate to the state of civilization to which a particular race has attained."

Deformities of the teeth, face and jaws are also very common (probably averaging as high as 50 percent), though the available statistics are too fragmentary to warrant final conclusions. "It is scarcely necessary to point out that the presence of such deformities interferes considerably with the exercise of the function of the teeth, and leads also to the development of other diseases."

The significance, therefore, of ***normal dental function,*** its influence upon jaw-growth and facial development during childhood, its relation to the health and well-being of the race, can hardly be overestimated. The dental axiom: ***only a normal mouth can perform normal functions,*** constitutes a tenet of a creed we were long in formulating, but one which is now quite generally accepted. And by a ***normal mouth*** we mean a mouth ***free from deformity,*** as well as from disease.

One of the most common complications of malocclusion of the teeth is a marked distortion of the facial lines. Frequently it is the only symptom which induces parents to seek a cure for their child's affliction.

In his *"Expression of the Emotions in Man and Animals"* Darwin demonstrated the unity of the races, and anatomical science has provided us with a fairly accurate description of normal facial development in the individual; but a critical analysis of *abnormal facial types* has hardly begun. A review of the

old literature is a fruitless task, because most of it is devoid of exact methods of investigation. Physiognomic research is largely a record of false conclusions, due perhaps to its too close association with phrenology. Krukenberg remarks that its scientific study began in earnest only ten years ago, and that it is still in its infancy. It therefore seems eminently worth while to attempt a presentation of a certain group of facts with which orthodontists are more or less familiar, but which have not yet gained that wide acknowledgment which their importance merits.

I. Normal Variations of the Head-form.

The human body, with its varied beauty of organization, is one of the most complex structures in nature. Normal variations of its form have long been considered worthy of serious study, and since Darwin's day they have been

A B C

Fig. 1.—Evolution of the Profile. (*a*) Infancy; (*b*) Maturity; (*c*) Senility.

pursued with a renewed earnestness. Blumenbach, Camper and Prichard were the pioneers in the study of the relation of the teeth and jaws to the facial lines of man.

This phase of scientific inquiry now forms an important division of ***anthropology*** where, in common with other elaborate methods of classification, it is termed ***anthropometry,*** the science of human measurements. The comparative study of the skull comprises a subdivision termed ***craniometry.*** When the measurements are taken from the living head it is termed ***cephalometry.*** Numerous methods for measuring human features have thus been proposed, and some of them have been sufficiently standardized to win universal acceptance.

In comparing a number of skulls even the beginner experiences little difficulty in detecting differences of shape. "The form of the head is for all racial purposes best measured by what is technically known as the ***cephalic index*** (Fig. 2). This is simply the breadth of the head above the ears expressed in percentage of its length from forehead to back. Assuming that this length is 100, the width is

expressed as a fraction of it. As the head becomes proportionately broader—that is, more fully rounded viewed from the top down—this cephalic index increases. When it rises above 80, the head is called *brachycephalic;* when it falls

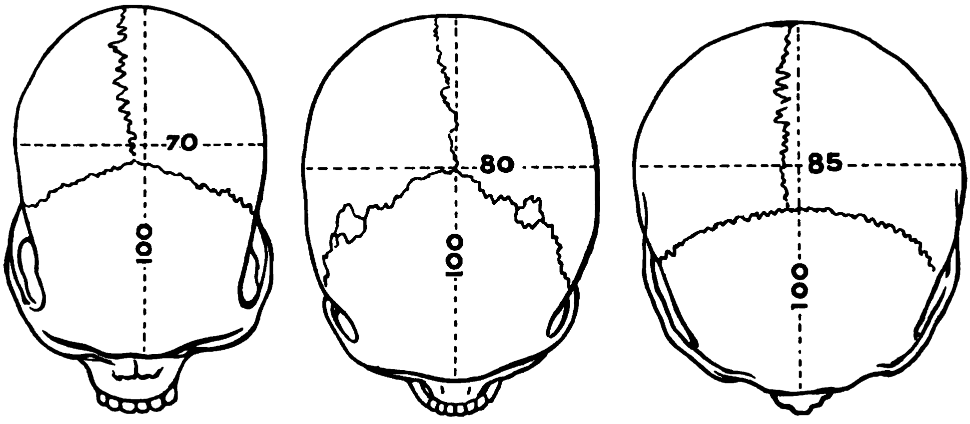


Fig. 2.—Cephalic Index. (*a*) Negro, index 70, dolychocephalic; (*b*) European, index 80, mesocephalic; (*c*) Samoyed, index 85, brachycephalic. (After Tyler.)

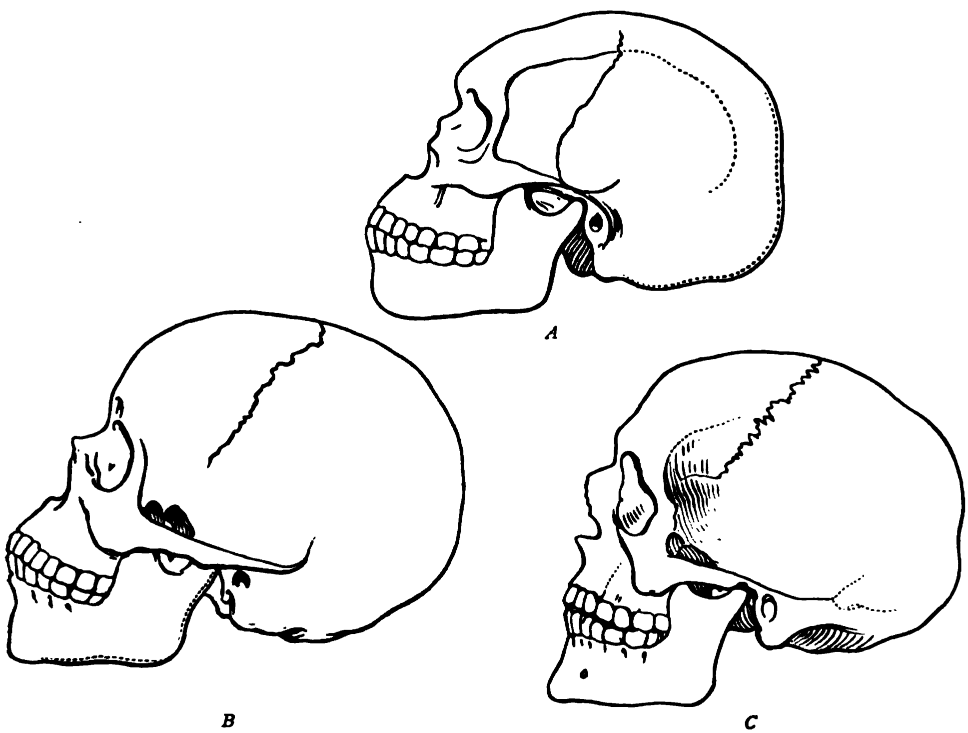


Fig. 3.—Gnathic Index. (*a*) Prognathic; (*b*) Mesognathic; (*c*) Orthognathic. (After Flower.)

below 75, the term *dolychocephalic* is applied to it. Indexes between 75 and 80 are characterized as *mesocephalic.*"

Variations in the form of the palate, classified by Turner into *dolichuranic, mesuranic* and *brachyuranic,* are also recognized, as well as variations due to

differences of development in the muscles of mastication. The latter may frequently be recognized in the (a) changeable position of the temporal ridge, (b) the differences in width of the rami of Europeans when compared with those of aborigines, (c) the varying degrees of parallelism of the borders of the rami, and (d) the outward and inward everted angles of the lower jaw, which affect the width of the lower part of the face.

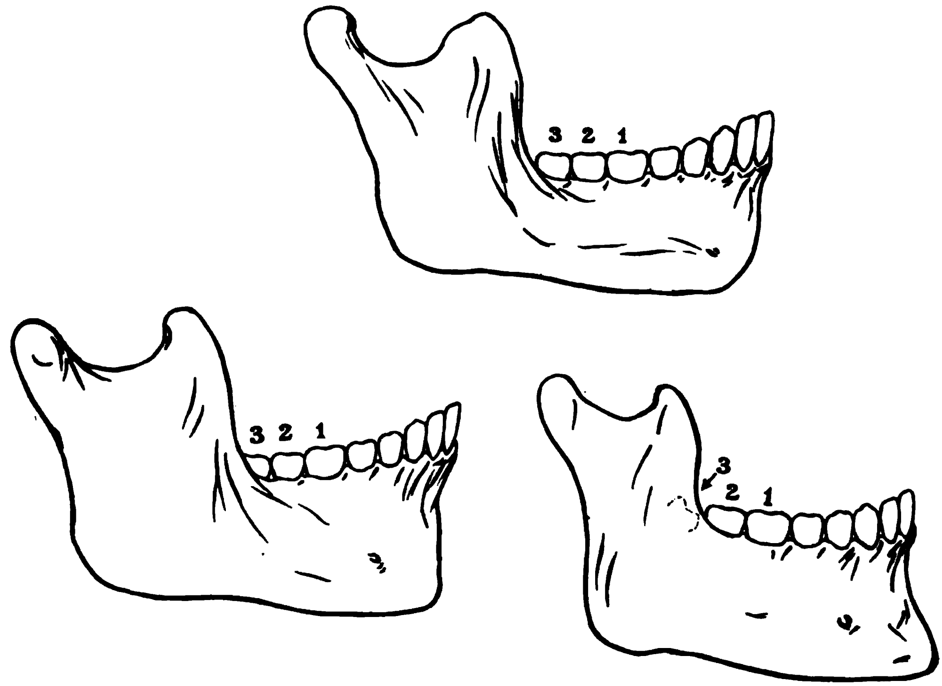
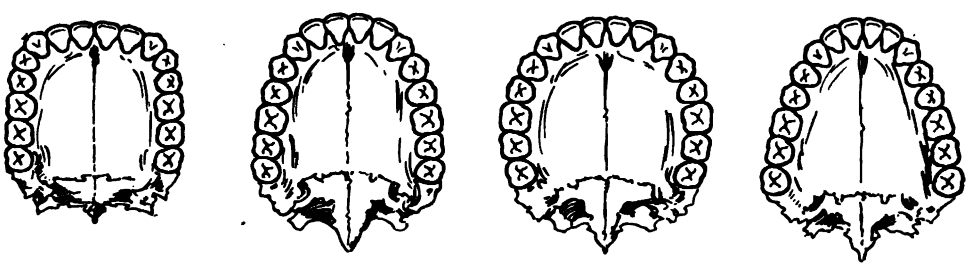


Fig. 4.—Variations in the relative positions of the lower third molars.



A B C D

Fig. 5.—Normal Variations of Alignment. (*a*) U-shaped; (*b*) Parabolic; (*c*) Hyperbolic; (*d*) Elliptic. (After Broca.)

II. Normal Variations of Dentition.

The history of the teeth, as explained by comparative odontology with the aid of fossil remains, is one of the most complete as well as interesting narratives which science has ever told; very few departments of knowledge can present a section of the past quite so completely. But like many other organs of the body, the teeth have not escaped the enervating influences which our changing diet and modes of life through centuries of time have imposed.

Swiss, Basle. Index 64.

Norwegian, Aamot. Index 75.

German, Baden. Index 83.

Hungarian, Thorda. Index 88.5.

Lapp, Scandinavia. Index 94.

French, Savoy. Index 96.

Fig. 6.—Illustrating the relation between face-form and head-form. (After Ripley.)

With the aid of Flower's ***gnathic index*** we are able to determine the relative projection of the teeth and lower part of the face, and to classify the races of mankind into the three groups: ***prognathic, mesognathic*** and ***orthognathic*** (Fig. 3). This variation is also noticed in the relative position of the lower

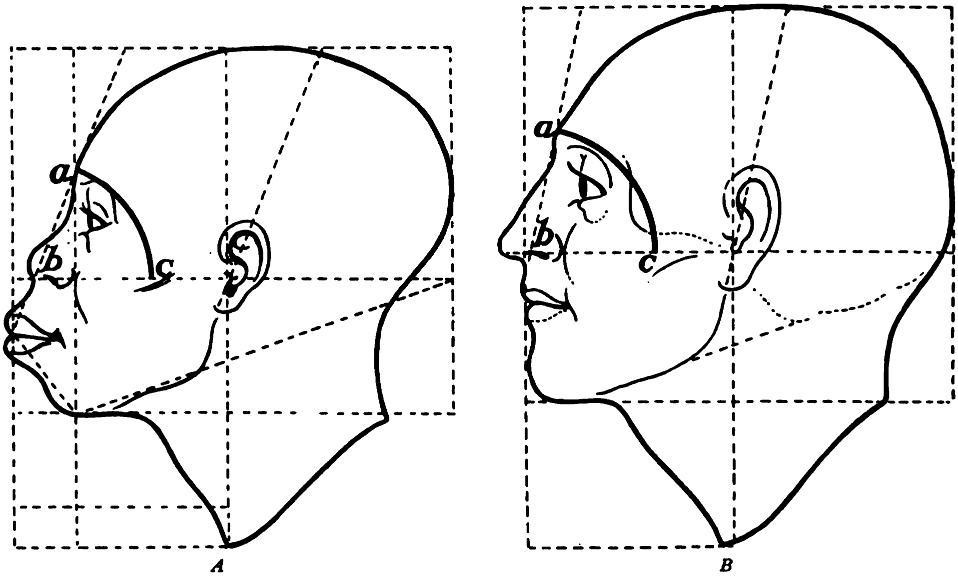


Fig. 7.—Facial Index. (*a*) Negro; (*b*) Caucasian. (After Camper.)

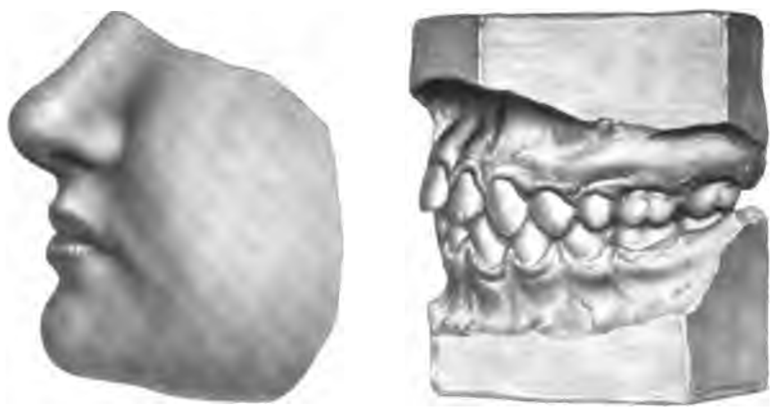


Fig. 8.—Prominent chin, with normal denture.

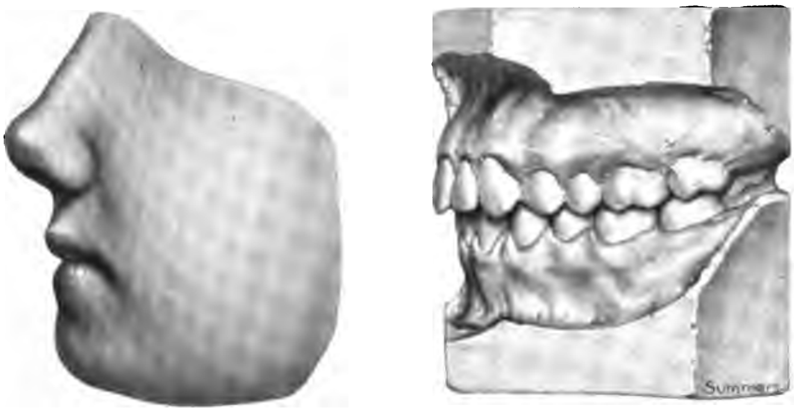


Fig. 9.—Straight chin, with normal denture.

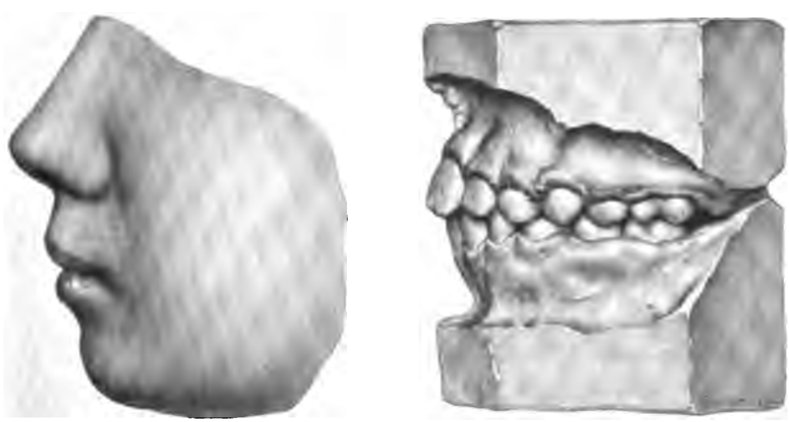


Fig. 10.—Receding chin, with normal denture.

third molars (Fig. 4). With the ***dental index*** we can determine the "relation of the size of the teeth to that of the skull" and get the three classes termed: ***microdont, mesodont*** and ***megadont.***

The noted French anthropologist, Broca, long ago called attention to the normal variations of alignment of the teeth, and suggested the four types: ***hyperbolic, parabolic, elliptic*** and ***U-shaped*** (Fig. 5).

Dr. J. Leon Williams, in a paper read before the National Dental Association in 1910, called our attention to the fact that the width of the maxillary dental arch followed closely the width and length of the zygomatic arches.

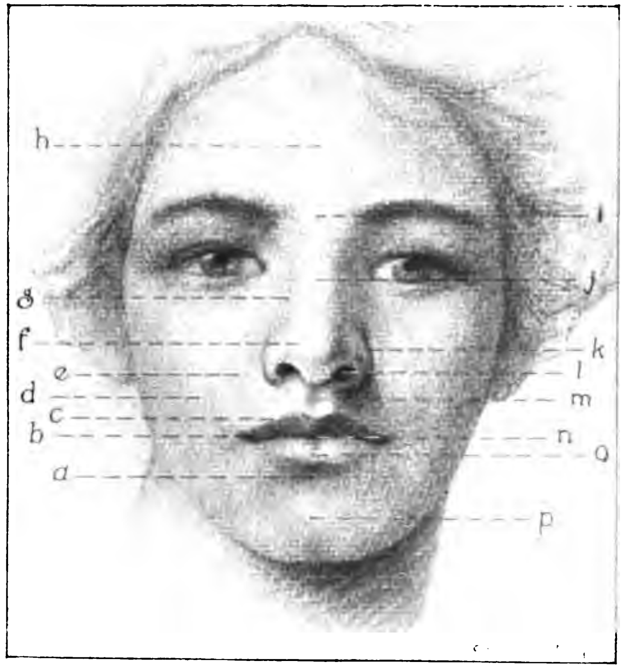


Fig. 11.—Principal features in the face, the relations of which may be altered by orthodontic treatment. Front view. (*a*) mentolabial sulcus, (*b*) angle (angulus oris), (*c*) upper lip, (*d*) cheek (bucca), (*e*) nasolabial sulcus, (*f*) tip (apex nasi), (*g*) base (basis nasi), (*h*) frontal eminence, (*i*) root (radix nasi), (*j*) dorsum (dorsum nasi), (*k*) ala (ala nasi), (*l*) nostril (nares), (*m*) philtrum, (*n*) aperture (rima oris), (*o*) lower lip, (*p*) chin (mentum).

III. Normal Facial Types.

It is a matter of ordinary observation that every face presents lineaments of character which stamp it with individuality; probably no other part of the human body shows so marked a tendency to variate in features and contour. Under normal conditions, the various elements of the face frequently combine in so harmonious a manner that the whole reveals a striking symmetry.

In his work on "The Races of Europe," Professor Ripley adopts the rule: "long head, oval face; short head and round face. In proportion as the head becomes broader back of the temples, the face appears relatively shorter (Fig. 6). Only a few examples of widespread disharmonism as it is called, between head and face are known. Among these are the Greenland Eskimos, notwith-

standing the fact that they are almost the longest-headed race known. The Aborigines of Tasmania are also *disharmonic* to a like degree, most other peoples of the earth showing an agreement between facial proportions and those of the head which is sufficiently close to suggest a relation of cause and effect. In Europe, disharmonism is very infrequent among the living populations. At times disharmonism arises in mixed types, the product of a cross between a broad and a long-headed race, wherein the one element contributes the head-form while the other persists rather in the facial proportions. Such combinations are apt to occur among the Swiss, lying as they do at the ethnic crossroads of the continent."

A widely used method of measurement applicable to the profile is that sug-

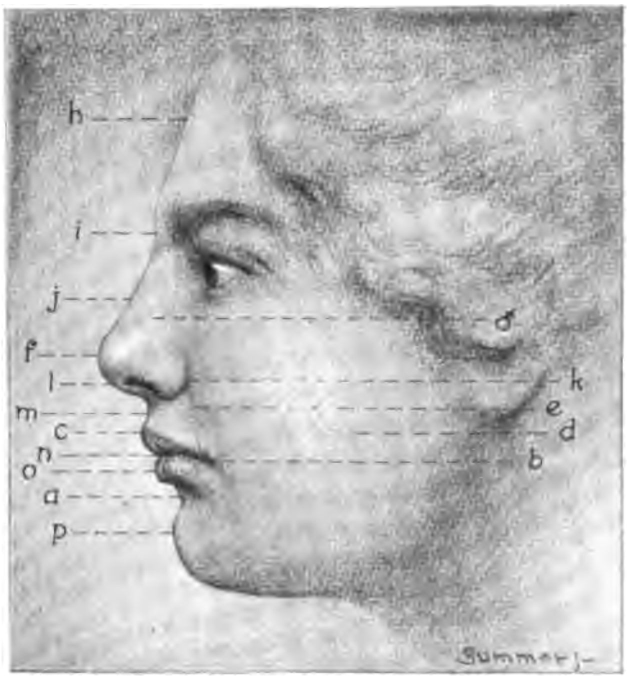


Fig. 12.—Principal features of the face. Side view. (*a*) Mentolabial sulcus, (*b*) angle (angulus oris), (*c*) upper lip, (*d*) cheek (bucca), (*e*) nasolabial sulcus, (*f*) tip (apex nasi), (*g*) base (basis nasi), (*h*) frontal eminence, (*i*) root (radrix nasi), (*k*) ala (ala nasi), (*l*) nostril (nares), (*m*) philtrum, (*n*) aperture (rima oris), (*o*) lower lip, (*p*) chin (mentum).

gested by the Dutch anatomist, Peter Camper, and technically known as the *facial angle.* "This gave an angle of about 20° for a dog, 85° for an Australian black, 95° for a European, and the Greeks used an angle of 100° or more to express their ideal of beauty and of intellectual power" (Fig. 7).

Deviations of form in the bony structure of the chin (which is closely related to the teeth and largely influenced by their growth) are naturally of compelling interest to the orthodontist. The normal variations of form of the symphysian angle result in the three types known as the ***prominent, straight*** and ***receding chin.*** These are frequently associated with a normal, as well as abnormal, denture. When a prominent, or receding, chin is found as a complica-

tion of malocclusion, the orthodontist finds himself confronted with one of the most difficult problems with which he has to deal (Figs. 8, 9, and 10).

Normal variations of form in the muscles of the lips, cheek and tongue are also recognized, as well as deviations in the size of the oral aperture, termed *microstomia* and *macrostomia.* The relation of the lip line to the occlusal plane of the teeth varies considerably, and it is also a matter of common knowledge that so prominent a feature of the face as the nose varies greatly in size and form, even within normal limits. Again, no two beings have eyes that are alike, for these, too, vary greatly in their color, size and position.

The principal features of the face which are the special concern of the orthodontist are shown in Figs. 11 and 12. The relative place which each of these features ought to occupy constitutes the student's first object of study. Having secured in his mind the position and form of each part, he comes to the second problem, viz., *The rearrangement of malplaced and malformed parts* in the faces of his patients. That this can frequently be done is one of the many notable achievements of the modern art of orthodontics.

(To be continued.)

THE TEETH AS FACTORS IN THE ECONOMY OF THE ANIMAL KINGDOM

By Martin Dewey, D.D.S., M.D., Kansas City, Mo.

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THE conviction has often been forced on those engaged in the practice of orthodontia that the majority of individuals seeking the service of an orthodontist for the treatment of malocclusion in children do so with the idea of improving the facial beauty of the child. It is very seldom that the orthodontist is called on to correct a case of malocclusion for the purpose of increasing the masticating efficiency of the teeth. It is also true that the majority of people who seek the service of a dentist do so for the purpose of alleviating pain instead of increasing the masticating efficiency of the dental apparatus. In fact, those who are engaged in the construction of crowns and bridges are often compelled to have a long argument with the patient in regard to the necessity of having a bridge inserted before the patient will consent to have such work done. In other words, the majority of people who engage the service of the dentist or orthodontist do so with the idea of being relieved of pain by the one or having something done by the other which will increase their facial beauty. This idea is entirely wrong, for the aim of all dental operations, whether of an orthodontic or other character should be to increase the masticating efficiency of the dental apparatus. While it is apparent to every one practicing orthodontia or dentistry that teeth in malocclusion do not perform their function as well as when in normal occlusion, nevertheless it is probable that few people have considered the important factor the teeth have played in

the preservation of animal life. Very few people realize that the animal kingdom, as we find it today, would not exist if it were not for the teeth. We often speak of the intricate workings of the brain, the wonderful effects of the human mind, and are even impressed with the intelligence displayed by certain lower animals, yet comparatively few people realize that the brain would never have developed, the human mind would never have been so powerful, even the lower animals would not exist as they are found today, if it had not been for the dental apparatus. There probably has been no one other set of organs which

Fig. 1.—Jaws of Shark (species unknown).

has been to such an extent responsible for the development of the animal kingdom, or which has played such an important part in the different kinds of animal life, as have the teeth. It is a fact that comparatively few persons sufficiently appreciate their dental apparatus, and probably the majority of the lower animals are not troubled about "oral hygiene" for, fortunately, most of them are not subject to dental ills if they are living in the natural environment in which their teeth developed. It may be taken for granted that, without the development of the dental apparatus in the various animals as we find it today, such animals would not be in existence. In fact, without the development of

the dental apparatus, animal life would not increase very much beyond the single-cell forms. The animal life in such case would necessarily have remained in the elementary stage, or would have been represented by such animals as we find today that are devoid of teeth, and which are of very simple structure, being composed of only a few cells, and some of them composed of only a single cell.

If we begin with the study of those organisms which are composed of very simple cell masses, whose alimentary tract consists of a simple sack with a single opening, we will find even at this stage that the cells surrounding the oral opening become larger, and are the beginning of the development of the

Fig. 2.—Teeth of Pickerel (*Esox lucius*), showing teeth on vomer and palates.

dental apparatus. As we approach the insect life we do not find, as a rule, true teeth, but nature has made a provision for a dental apparatus by supplying the animal with serrated jaws, which are analogous to teeth, with which he is able to secure his food, and with which he is able to perform the secondary function of the teeth—namely, that of defense and offense. The invertebrate, as a rule, are devoid of true teeth, but when we pass to the vertebrate we find teeth are the common rule. In fact, in the lower vertebrate we find that the dental apparatus reaches a high degree of perfection before any of the other organs attain a similar degree of completion. In the lower forms of fish, which are represented by the cartilaginous species, of which the shark is an example, we find a dental apparatus (Fig. I) which is particularly suited to the animal's needs, and which apparatus has largely been responsible for the continued ex-

istence of that primitive animal even up to the present time, when it is forced to live in an environment which tends to destroy it in great numbers. The dental apparatus of the shark is particularly efficient for its needs because it is composed of a large number of teeth. These teeth are attached by fibrous membrane, but are of continuous succession, and it is this continuous succession and rapid development that has enabled the dental apparatus to serve the animal so efficiently. The teeth of a shark are simply modified placoid scales, which have been carried into the oral cavity by a process of development and have become larger to serve the needs of the animal. We may consider the dental apparatus of the shark as representing one of the first set of teeth used for the economy of the fish and which were necessary for its existence.

Fig. 3.—Sargus, incisor-form teeth ankylosed to jaw. Posterior teeth for crushing. Antèrior teeth for incision. Heterodont. (Author's collection—Roentgenogram by Dr. E. H. Skinner.)

Fig. 4.—Teeth of *Crocodilus niloticus.*

In various bony fish we find the dental apparatus has reached a higher state of perfection in that certain teeth have become specialized and have been made to perform a certain definite function. As a result, the economic condition of the animal has been greatly increased, and it has been able to utilize a class of food which cannot be consumed by the shark. In the pickerel (Fig. 2) we find teeth placed upon the palate and vomer to perform the function of prehension and deglutition, while the teeth on the mandible perform the function of prehension. Those who indulge in the sport of catching pickerel may never have understood that the peculiar habits of the animal were due to the teeth it possessed. If toothless pickerel were developed, the tactics of angling for the fish would have to be changed as the habits of the toothless pickerel would be entirely altered, and it would be forced to eat a different kind of food.

In fact, the very nature of every animal depends on the teeth. Fig. 3 shows a dental apparatus of the sargus, whose teeth are decidedly different from those of the pickerel, and which necessarily leads a very different life and eats other kinds of food.

In an economic consideration of the teeth as a factor in the production of and influence on animal life, we leave the fish and pass to the reptiles, of which there are many kinds. Investigations inform us that ages ago the world was largely inhabited by enormous reptiles, whose dental apparatus was very similar to that of the alligator and crocodile of today. The dental apparatus of the alligator and crocodile is not very efficient, but the animal has managed to exist

Fig. 5.—Teeth of Gila Monster (*Heloderma*).

Fig. 6.—Teeth of Rattlesnake (Crotalus adamanteus). Highly specialized poison fangs.

because it has lived in certain haunts that are difficult for man to explore. The development of their strong exoskeleton has made them immune to the attack of most animals except man, and therefore they still exist in large numbers. The dental apparatus of the alligator and crocodile, while not so efficient as that of some of the other reptiles, is, however, suited to their particular needs, and is of sufficient utility for the class of food found in the habitats of those animals. Other animals closely related to the alligator and crocodile, such as the various kinds of lizards, have also adapted themselves to certain environments and their dental apparatus has likewise become of economic importance. We refer to the gila monster (Fig. 5) which inhabits the desert, and has a dental apparatus suited to its particular needs in its environments. Of the other rep-

tiles, we may refer to the snakes, which are poisonous and nonpoisonous, both kinds having dental apparatus that is very efficient. Of course, the poisonous snake possesses a dental apparatus that is specialized to a greater extent than that of the nonpoisonous, and the abhorence in which the entire snake family is held is based on the characteristics borne by the poisonous snake. The dental apparatus of the poisonous snake is efficient to a high degree (Fig. 6) and seems to be developed to a condition of effective preparedness, with the result that all of its nonpoisonous cousins are placed in the same category and are made to unjustly suffer for its sins. In America we have only two families

Fig. 7.—Teeth of *Python regius*, used for prehension and deglutition.

Fig. 8.—Teeth of Kangaroo (*Macropus giganteus*).

of poisonous snakes that exist to any considerable extent today—namely, the rattlesnake and the copperhead. We have many varieties of nonpoisonous snakes that possess dental apparatuses which are efficient for securing food and which are necessary for the life of the animal. Nonpoisonous snakes may possess a large number of teeth, which are used for the functions of deglutition and prehension (Fig. 7). The poisonous snake as shown in Fig. 6, has fewer teeth, but their efficiency is increased by continuous succession, as the animal is never without a set. Nature has provided the lower animals with a dental apparatus which suits their needs, and, while it may be defective in some respects in certain animals, it has enabled the animals to exist during their allotted terms of lives.

We find some animals are devoid of teeth, but they possess analogous apparatuses that are highly developed. We refer to the beaks of various birds, and these beaks may be considered to be more highly specialized, from a dental standpoint, than some of the dental apparatuses of lower animals, as geological remains show that the earlier types of birds possessed teeth.

Of the higher animals we may mention the marsupials, a class of animals that have ceased developing at a stage which most other animals passed years ago. From a dental standpoint, however, the marsupials are very well supplied, and, in fact, are better supplied than some of the mammals. The kangaroos of Australia (Fig. 8) possess a dental apparatus which is a highly specialized herbivorous type, and enables them to lead a life and secure food where it would be difficult for other herbivorous animals, or even rodents, to exist. The arrangement of the upper and lower incisors makes it possible for the animal to obtain food where such animals as the sheep and cow would starve, and presents a case where the very existence of the animal depends on the den-

Fig. 9.—Roentgenogram of jaw of Woodchuck (*Arctomys monax*). (By Dr. E. H. Skinner.)

tal apparatus. The dental organs of the American opossum (Fig. 9) are also very efficient, but in this case the teeth, as well as other portions of the animals, are passing through an evolutionary stage, and represent a condition between the carnivorous and herbivorous dentition. In fact, some of the teeth of the opossum resemble those of the carnivorous animal, while other teeth resemble those of the herbivorous. The specialization of the dental apparatus of an animal does not necessarily depend on whether it is a marsupial or whether the young are born in the nature stage, for, as has been stated, the teeth of the kangaroo are more highly specialized than those of some of the higher mammals. There is a little marsupial in Madagascar that resembles a squirrel and has a rodent dentition—that is, the animal possesses large scalpriform incisors, which grow from persistent germs, and it is the peculiar teeth of the animal which enable it to secure a diet which the other marsupials cannot obtain. Rodents represent a class of animals which, from a dental standpoint, is very interesting, for the very existence of practically all rodents depends on their dental apparatus. We cannot imagine that any rodent would exist very long if it were to lose the incisors, as they are the more important teeth. Of course, the loss of the molars would be inconvenient, and

their absence would probably hasten the death of the animal. More or less is known about the wonderful habits of the beaver (Fig. 10) and the great intellect which the animal displays, but this intellect would be absolutely useless and the animal would be extinct as a class if it were not for its peculiar teeth. The teeth are useful not only as organs for securing food, but also as tools with which to do the particular type of building for which they are noted. In many of our American cities some of the parks are the abiding places of a large

Fig. 10.—Teeth of Beaver (*Castor canadensis*). Side view.

Fig. 11.—Teeth of Squirrel (*Scurius niger*).

number of squirrels, which seems to be the only animal that is able to exist with any degree of safety in those surroundings, and this is because the squirrel (Fig. 11) is able to obtain food in a way that is denied the majority of other animals. The squirrel is able to open nuts, that are found on some trees in the parks it frequents, and the formation of its dental organs has enabled it to take up abodes where no other animals could exist.

The statement has been made that, should certain animals lose their teeth —or by some means lose the use of their teeth—they would soon die, and an example of such an occurrence is illustrated in Fig. 12. Here is shown the

skull of a squirrel which met with an accident, and the central incisors, failing to occlude, continued to grow from a persistent pulp until the animal starved to death as a result of the accident.

Of the carnivorous animals the lion (Fig. 13) is a good example. The position which the lion occupies in the animal kingdom, both actually and theoretically, being called the king of beasts, is because of the dental apparatus which it possesses. The carnivorous animals do not possess certain teeth because they are carnivorous, but, conversely, they are carnivorous because they possess that type of teeth. Just what has been responsible for the development of the dental apparatus of the carnivorous animals will probably never be known, but from some cause such a set of teeth has developed, and consequently the entire nature of the animal must conform to the teeth. We are not prepared to state positively that a certain dental apparatus has developed to meet the particular needs of the animal, but we will say that, after it has once developed,

A *B*

Fig. 12.—Skulls of Squirrels, showing excessive growth of incisors as a result of injury.

the animal is dependent on it for its continued existence. In other words, if a carnivorous animal were to lose the canine teeth, it would die in a short time. The teeth of the herbivorous animals (Fig. 14) are just as important for their purpose as the teeth of the carnivorous animals, and have been specialized in a manner that compels the animal to follow a certain habit. We are reminded of the story of the dog in the manger, which could not eat the hay, and, because he could not eat it, refused to let the ox have it, which may have made the impression as being a fable, but which nevertheless has a certain scientific bearing when viewed from a scientific standpoint.

These few examples in regard to the teeth of certain animals will, we believe, enable the reader to understand what we mean by the statement that the teeth are economical factors in the preservation of animal life. If, therefore, the teeth have been so important a factor to the lower animals, the question naturally arises how much of a factor are they in the economy of the human family today? We are of the opinion that they play a much greater part in the individual than has been attributed to them, and we believe that an examination of the records of men who have attained great success today would disclose the fact that they obtained their greatest achievements during the time

when their dental apparatus was in the best condition. We can make the statement with little fear of contradiction that an individual after he has lost his teeth is making a losing fight. We believe that if in the case of two boys each twelve years of age and of the same physical development and same intelligence, one should have all his teeth extracted, and even supplied with the best artificial denture, the one with the artificial teeth would be a very poor second to the individual with natural teeth. In fact, we feel that it is impos-

Fig. 13.—Teeth of Mountain Lion. Side view.

Fig. 14.—Occlusal view of teeth of Antelope (species unknown).

sible for an individual to reach his highest degree of efficiency unless all of his teeth are in normal occlusion and performing their proper function. Even the loss of one tooth will impair the masticating efficiency of the dental apparatus and this impairment of the dental apparatus will correspondingly lessen the efficiency of the individual. In our observation of people, if we find a man 70 years old who possesses all of his natural teeth, he will be an individual who is vigorous and who possesses physical and mental strength far superior to another man of 70 years who lost all his teeth at the age of 40.

If, as explained above, the teeth have played such an important part in the development of lower animals, it is logical to conclude that they have been an important factor in the development of man, and, if they have been such essential organs to men's progress, it is illogical to suppose that in the course of time they will lose their efficiency and cease to be of economic importance in the life of the human being. While it is a fact that individuals can live without teeth (they can be supplied with certain artificial substances) it is our opinion that the individual who possesses artificial teeth will be at a disadvantage when compared with the individual with a normal set of teeth. It therefore becomes our duty to impress our patients with the fact that malocclusions should be treated, not on account of the esthetic feature, but because of the importance of well-arranged teeth as organs of mastication, and the influence which they will have on the physical and mental development of the individual.

ORTHODONTIA—ITS PLACE IN DENTAL EDUCATION*

By Lawrence W. Baker, D.M.D.
Assistant Professor of Orthodontia, Harvard Dental School, Boston, Mass.

It is a generally observed fact that the most progressive and active minds in our profession are interested in the training of those who are to enter our ranks, in other words, they are interested in the advancement of dental education. Therefore I thought that my fellow graduates of the Angle School might be interested to hear something about the methods and see some results of these methods in teaching orthodontia in the Dental School of Harvard University.

At the very outset I would like to state the aims of the Orthodontia Department. While it is not our purpose to educate, at least in the regular curriculum, specialists in orthodontia, we do regard the study of orthodontia as one of the fundamentals in teaching the modern student of dentistry. The study of orthodontia links together the student's knowledge of anatomy, histology and embryology as no other dental study can, for these subjects are the very structural elements of the theory of orthodontia. The student's mental horizon is furthermore broadened by a knowledge of comparative dental anatomy, that fascinating study which leads the diligent student on to a keener appreciation of the wonderful variations and architectural plans of the human types, gained through the study of the dental systems of the lower animals with their marvelous physiological adaptations to the foods and habits of the species; all of which reflect the great principles of evolution.

Practical orthodontia is also very important in revealing to the student the wonders of the dental apparatus, for here this most intricate piece of nature's work is studied in its entirety, whereas in the various studies pertaining to operative and mechanical dentistry the students' attention is so focused on some manipulative process that they are apt to consider the dental system as made up of separate units, the relation of these units, one to another is lost sight of

*Read before the Eastern Association of Graduates of the Angle School of Orthodontia, May 20, 1915.

and it is only through practical orthodontia, only by transforming the malformed dental arches to the normal, that the student can begin to appreciate the relation and interrelation of these dental units in that great equilibrium, normal occlusion.

Indeed this transformation of these extreme malocclusal forces (examples of which I propose to present soon) to the normal, shows the student, in a most striking manner, the important and close relationship of the reaction of these occlusal forces on the development of the skull as a whole.

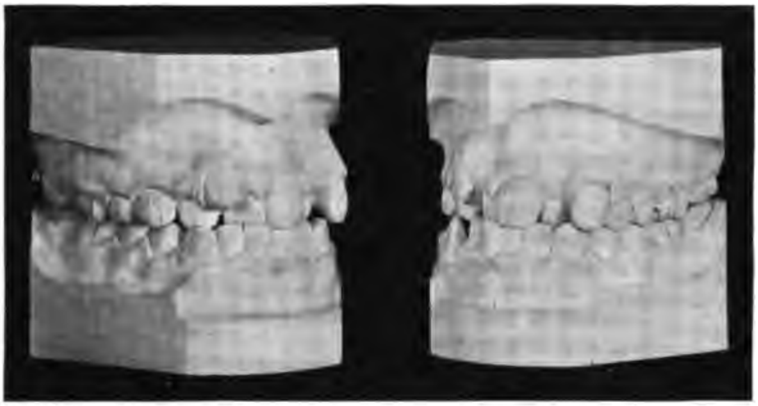

Fig. 1.

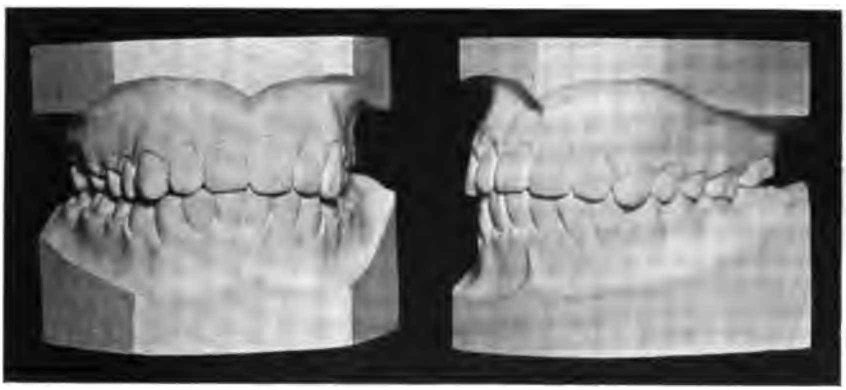

Fig. 2.

Practical orthodontia, the modeling of ugly and inharmonious facial lines to lines of grace and harmony does much towards training the student's sense of art and proportion and should awaken in him keen love for the beautiful, while the technic and clinical sides of orthodontia, dealing as they do with so many delicate forces and such intricate manipulative processes, unconsciously brings out to a remarkable degree the student's manipulative judgment and ability and at the same time trains those qualities so essential to success in practice, namely, patience and perseverance.

So in teaching this subject we strive to do so in a broad way. In fact it

is my fixed belief that the theory and practice of modern orthodontia does more to develop the student's personal skill, more to train his eye, his hand, and to inculcate good sound deductive reasoning than any other one dental study.

It must be borne in mind that I am discussing the subject from the standpoint of educating the student of general dentistry and not the specialist in orthodontia. I am firmly convinced, as I know every one of my fellow graduates of the Angle School is, that to train the true orthodontist, to educate men to practice and advance this most exacting science, the student should first be a selected man, one who has shown in the general course in orthodontia

Fig. 3.

Fig. 4.

that he is fitted, both mentally and temperamentally, to take up this skillful and patient work. Then these "sifted few" should be trained, both in the subject of orthodontia as well as in the collateral sciences, and this training should be presented to the student by skilled experts, so that the scientific knowledge of the world we may say is focused on orthodontia—this in my opinion is the best way to impart the spirit of orthodontia and to foster the love of science and research.

So much for a general consideration, we will now turn our attention to the practical. The questions you will naturally ask are: "Can results be obtained by general students of dentistry? Should practical orthodontia have a place in

the general curriculum?" These questions I will allow you to answer for yourselves after reviewing a few cases, the work of students under instruction, from the clinic of the Harvard Dental School.

Case I.—Fig. 1[1] illustrates the first case which I wish to present for your consideration—a difficult Class I case. One which would test the skill of a most experienced orthodontist.

Fig. 2 shows the student's result, obtained with the classical expansion arch appliance.[2] Not only did he render a real service to the patient, but he also received himself a great deal of educational value. Skilled orthodontists well know the concentration, and the delicate control of the many applied forces necessary to bring about such a result. This work is a striking example of what

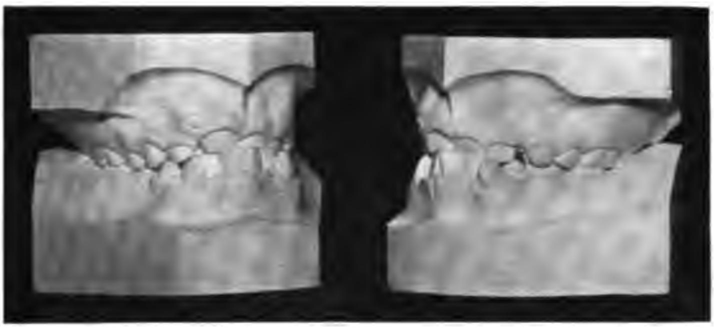

Fig. 5.

Fig. 6.

has been said regarding the value of practical orthodontia in training the student's mental faculties.

The palatal aspects of the upper arch are shown in Fig. 3.

Case II.—Fig. 4 shows quite an unusual type of a Class I case before and after treatment. Observe that the mesial aspect of the left central incisor presents itself anteriorly, and as its mate erupted it did so in a precisely similar manner.

While treating this case the student became so enthusiastic over orthodontia

[1]As a point of accuracy it must be stated that artistically these models have been improved upon, however the anatomical parts have not been altered and faithfully show the work of the students.
[2]The expansion arch principle was employed in the treatment of all the cases here presented.

that he became determined to be a specialist in this field of work and he is now one of us.

Case III.—Fig. 5 is a most interesting study in the forces of occlusion, for the five cardinal principles which accompany normal occlusion have been completely overthrown.

The result (Fig. 6) clearly shows the skilled orthodontist that the fundamental laws of occlusion must have been thoroughly and deeply inculcated into the student's mind, and furthermore that to achieve this truly beautiful piece of work the student must have had indelibly stamped on his mind those five great cardinal principles of normal occlusion. The student well knew that

Fig. 7.

Fig. 8.

Fig. 9.

normal occlusion signifies: first, maximum utility, second, that normal occlusion means the establishment of nature's laws of self-cleansing, third, that normal occlusion brings about normal bone growth, fourth, that normal occlusion is accompanied by normal facial lines and lastly, but not least, that the establishment of normal occlusion brings about that ever sought equilibrium of the occlusal forces—nature's retainer.

Case IV.—Fig. 7 was an unusually interesting one from the teaching standpoint. In the first place the students could plainly see that the impaction of both the superior cuspid teeth caused an arrest in the development of the superior maxillary bones and this skeletal deformity caused a consequent inharmonious development of the facial lines.

Secondly, a certain amount of knowledge of radiography was necessary for a complete diagnosis. The position of the right cuspid was easily diagnosed

without the aid of the x-ray, for the characteristic swelling of the bone showed that it lay palatally to the dental arch; but there was no indication of the presence of the left cuspid whatsoever as it was so deeply embedded. However

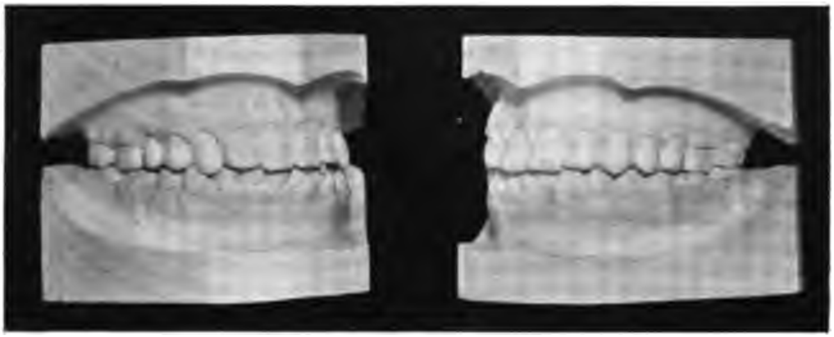

Fig. 10.

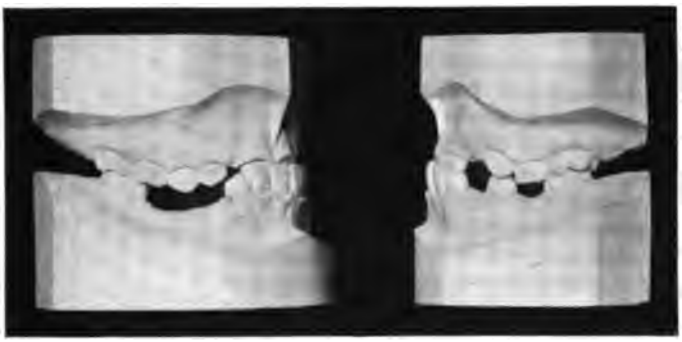

Fig. 11.

Fig. 12.

the x-ray revealed its presence as shown in Fig. 8. The arch was expanded and thus space was made for the missing unit. Later a skiagraph revealed, as we see in Fig. 9, that the tooth had righted itself and was descending to place. Fig. 10 shows how intelligently the student guided it into correct position. The right aspect of the completed case shows also that the impacted cuspid has on this side been successfully brought to the proper place.

Case V.—In Figs. 11 and 12 still another Class I case is presented for your consideration. The treatment of this case is not difficult, nevertheless it does possess several unusual educational features. First to classify it requires keen observation and a thorough training in that basic principle of modern

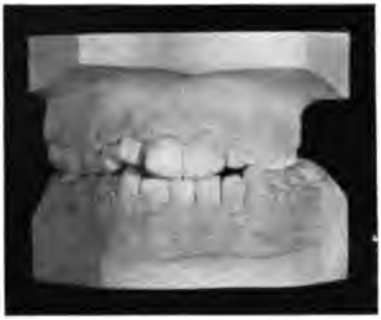

Fig. 13-A.

Fig. 13-B.

Fig. 14.

Fig. 15-A.

Fig. 15-B.

orthodontia, the Angle Classification. A poorly taught student might easily classify it as belonging to Class III, but one well grounded in this fundamental will carefully observe the molar relations and group it as a member of the first great class.

Another interesting feature is that no appliance was necessary to retain

the case after treatment. It was self-retaining—still another example of that cardinal principle, that the occlusal equilibrium is nature's retainer.

Case VI.—Fig. 13-A presents to the student a problem in anchorage. It will be observed that the left side of the superior arch is in lingual occlusion, and to make this side normal it will require skillful handling of every ounce of the available anchorage, for it is a case of pitting one lateral half of the arch against the other lateral half. Members of this society well know the procedure of employing "mass anchorage" and all the technic which goes with it.

Fig. 16.

Fig. 17.

Fig. 13-B shows the skillful work of the student, for the result has been accomplished without upsetting the anchorage. Fig. 14 shows the palatal aspect of the superior arch before and after treatment.

Case VII.—Fig 15-A shows a condition brought about by a pernicious tongue habit, and we see in Fig. 15-B the results of the student's perseverance in combating this deeply rooted habit.

Case VIII.—This case (Fig. 16 and Fig. 17) might be fittingly termed a "Harvard product," for the orthodontic work is a product of the Orthodontic Department of the Harvard Dental School, the skillfully constructed crowns

and bridges, the product of the Prosthetic Department, the beautiful gold inlays the product of the Operative Department, while the patient himself was a student in the Harvard Academic Department, and he is now a loyal supporter of the Harvard Dental School.

Fig. 18-A is a photograph of a typical sufferer of Class II, division 1. Note

Fig. 18-A.

Fig. 18-B.

Fig. 19-A.

Fig. 19-B.

the vacant stare. In Fig. 18-B observe the transformation—a bright, intelligent face. The keen-eyed student noted this change and asked the cause. My fellow practitioners well know the underlying cause—it is normal occlusion. The misplaced lower jaw has been brought forward to its normal position, there is full power of mastication, there is normal tongue room, there is normal respiration and there are normal facial lines. All this, combined, has given the boy his manly carriage and set up.

The next two photographs (Figs. 19-A and 19-B) illustrate in profile another case similar to the preceding, and again the same transformation is seen.

No thoughtful person can study these last four photographs without realizing that the correction of these deformities has changed the future of these dental cripples, for these deformities go deeper than mere facial disfigurements, they penetrate even the highest nerve centers and it is evident that their correction has had a direct and powerful influence in both the visible as well as the invisible—in other words—the treatment has brought about a far-reaching psychological change.[3]

I feel that it is not necessary to burden you with further illustrations of the clinical work of the students. But in conclusion it must be added that whatever success practical orthodontia in our school has attained and whatever value the clinic may possess as a charity is due primarily to a principle laid down by that great educator, President Emeritus Eliot, and this principle is the principle of individual instruction.

President Eliot pointed this out clearly in an address to our teaching staff and student body some years ago. Speaking of the mode of instruction in the Harvard Medical and Dental Schools, he called particular attention to the fact that the proportion between teacher and student was such that there was one instructor to every two students. Continuing he said, "This proportion without exaggeration is unprecedented. No such relation exists elsewhere in the university or in any other university. And the object of all this is to give individual instruction and to have this individual instruction presented to the students by skillful experts."

INHERITANCE OF MALOCCLUSION FROM A BIOLOGICAL STANDPOINT*

By T. G. Duckworth, D.D.S., San Antonio, Texas.

IN the January, 1916, issue of the *Dental Cosmos* appeared an article by Dr. C. H. F. L. Nord, of Gornichem, Holland, on the importance of biology as applied to dentistry. No doubt some will agree and others disagree with the views he has taken, and especially in reference to heredity and extraction. Nevertheless, he has, according to my way of thinking, stated some very true biological facts, as well as truths that are not biological.

Though I am fully convinced that the science of biology is of value in the understanding of the etiology of malocclusion, I am as yet unable to say positively that malrelation of the teeth and maxillary bones are ever inherited or even carry a hereditary tendency.

Drs. Angle, Case, Cryer, Jackson, Dewey, Goddard, Hellman and probably others have made statements which are conflicting. No doubt those men have

[3]The psychological effect produced by the treatment of Class II, division 1, was alluded to by me in "A Consideration of the Occlusal Balance," read before the New York Institute of Stomatology, Nov. 4, 1904, and published in the International Dental Journal, December, 1905, Vol. xxvi, No. 12, pp. 788-9.

*Read before the Sixth Annual Meeting of the Alumni Society of the Dewey School of Orthodontia, Kansas City, Mo., February, 1916.

reasons for their statements, for they are the result of many years of study and observation.

The burden of proof from any of these statements is so lacking and the expansion of literature is becoming so great that we often find answers coming back from where we started. As yet we must draw our own conclusions as the result of study and observation, as to whether malrelation of the teeth and maxillary bones is hereditary, congenital or acquired. Wallace, Galton, Darwin, Weismann and others have all had something to say in reference to heredity, but do they point out directly or indirectly that malocclusion of the teeth is inherited or that it is not inherited? If time would permit, it would be a beautiful thing to go into some of the biological facts which would lead up to a proper conception of the laws of heredity, but the expansion of literature is so great upon the subject that I will have to treat it simply on the surface.

The Writer's Views.

In my opinion from the study of anatomy, embryology, histology and biology there is no disease, or malformation, that is directly transmitted from parents to offspring as the result of being impressed upon the chromatin of the germ cell. No doubt there are many instances in which disease has lowered the vitality of the chromatin of the male and female pronucleus to such extent that they are incapable of fulfilling their normal function, and if continued through generations would progress toward degeneracy; however, this would not interfere with the normal impressions of transmission upon the chromatin of the germ cell, except to lower its activity in producing a healthy individual, which is necessary in bringing out the characteristic race attributes.

So long as an individual develops along the lines of perfection and in harmony with the type intended which is governed by environment, it is to that extent hereditary. Any deviation from this course can be attributed to congenital or acquired causes. Apparently in the same sense that the centrosome presides over cell division and the chromosomes over the species, the virulency of the chromosomes presides over the sex. For instance, the virulency of the chromatin of the male germinal cell predominates over the chromatin of the female germinal cell which will be productive of the male sex carrying with it the characteristics of the father, while on the other hand the virulency may predominate in the female germinal cell carrying with it like characteristics. Where the virulency of the chromatin in both sexes is near the same degree we have the offspring resembling both parents, latent characteristics no doubt predominate at intervals in which the offspring will resemble some of its ancestors.

The teeth are intended and are used for a useful purpose and when we find deterioration of tooth structure as is exemplified in the human race and which has caused so much suffering and which is repaired only by artificial means, it is reasonable to believe there must be some degenerating elements working upon the race as a whole, which is not exemplified to the same extent in lower animals.

The degenerating elements working upon the teeth of the human race can well be defined in most every individual, which cannot be said in reference to

any of the lower animals; in fact, there are no deteriorating elements working upon the teeth of the lower animals that can be said to exist to any degree over one class than over another,—however the degree in the human race is much greater, and very probably the difference lies in the mode of living which is so radically different from that of the lower animals.

One of the known causes of malocclusion, is lack of proper use of the tissues that go to make up the dental apparatus. This is well exemplified in other tissues of the body that were intended for useful purposes which have not developed as the result of lack of sufficient and proper use,—however, these tissues were intended in the makeup of the individual, therefore, were impressed upon the chromatin of the germ cell. On account of the mode of living these tissues are not put to serviceable use (which accounts for their lack of development) and are oftentimes removed by surgical means, as their presence is often objectionable, rather than doing good in the present way of living.

Take the present known or supposed causes of irregularities of the teeth and maxillary bones, make a thorough study of each,—the results will be congenital or acquired. Very likely inherited and congenital conditions have been viewed from the same standpoint, taken for granted that all congenital conditions are inherited, which would lead to conflicting ideas and statements. Clinical observation based upon a study of normal development of plant and animal life will often be sufficient proof to justify a positive statement, but to demonstrate it becomes quite a problem.

Family Traits.

"Family traits" is a familiar way in which certain types of malocclusion were referred to by certain writers who based their theory principally upon the fact that in the sons and daughters irregular teeth were the result of irregular condition of the teeth of the parents, direct transmission from parents to offspring,—this refers especially to Class III and Class II, Division 1 cases.

Intermarriages of Races or Mixing of Types.

"Intermarriages of races" or "mixing of types" has often been referred to as producing certain malformations of the jaws and associated tissues as the result of parents being of different physical size, producing an offspring in which the child would inherit the small jaws from one parent and the large teeth from the other. These views are in direct contrast to the laws of nature. It was not intended that the gateway to the alimentary canal be so distorted as to hamper the individual in building in the most favorable manner a strong and healthy body. On the other hand, after the impression of heredity has been made, the individual must live in a state of perfection and in keeping with the impressions made by heredity. The mode of living in a state of perfection has probably never been realized, but it is possible, and until it is attained we must revert back to congenital and acquired conditions.

On examining the mouths of several hundred school children, it was noted that tissue deterioration and malocclusion were most prevalent in children of a very young age. So long as the teeth are allowed to decay and the gums are

continually diseased, and the nasal passages are obstructed, malocclusions are going to exist. Pyorrhea specialists tell me that a great many cases of diseased gums are found in well kept mouths, showing that sanitary precaution in itself is not a preventive to infection and must be eradicated by raising the resistance of the tissues by a gradual change in the mode of living.

Differentiations have been made between living and nonliving substances, all of which are capable of being resolved into one or more of the simple elements of which they are composed. Living substances, complex as they may be, fulfill their mission in a variety of ways, some answering as food for other living substances, which also may be poisons for still others, and so on through the chain of living organisms. Anything capable of assimilation, growth, reproduction and locomotion is said to be of the living variety and is endowed with the power of transmitting through generations its original identity.

The nonliving substances are incapable of assimilating, therefore cannot reproduce, grow, nor can they change locations by their efforts. It is only in their most elementary forms that their identity is retained. It is through heredity that animal and vegetable identity is retained.

Dental Authorities.

I will mention some of the views of dental authorities for and against hereditary malocclusions.

Dr. E. H. Angle.—"Every individual shows a certain harmony and beauty; the short built and round-headed shows a more rounded dental arch with short and broad incisors. In a case with a tall individual with long, narrow face, we find the long and narrow arch with the incisors much more inclined. Nature does not make the mistake of having a child inherit a short leg from the mother and a long leg from the father, or a narrow arch from the mother and broad teeth from the father; on the contrary, the child either resembles the father or mother, or both, or does not look like either one of them, thus differing from each, but possessing teeth and jaws and legs and face and other extremities in harmony with the entire type, just like everything is in harmony in the case of the parents."

Dr. C. S. Case (*"Extraction in Orthodontia."*).—"For nature knows no law of esthetics, no matter how beautiful and harmonious her productions may be. Every wrong position which we may find in dental and dento-facial relations points immediately to the law of heredity as a cause of many malocclusions of teeth."

Dr. M. H. Cryer.—"I fear that those who assert that all causes of irregularities of the teeth are postnatal have not read, and still less studied, the laws of cross-breeding and of heredity. The researches and writings of Mendel, Darwin, Weismann, De Vries, Burbank and others tell us that all variations are determined by the laws of heredity, except those arising from accidents."

Dr. Martin Dewey.—"From an embryological standpoint it is impossible that a child inherit the lower jaw from one parent and the upper jaw from the other."

Dr. V. H. Jackson. (*"Orthodontia."*).—"One of the most prevailing causes

of irregularities of the teeth is the marriage of individuals with different characteristic race attributes. Very often we see the case of a child inheriting the small jaw of one parent and the large teeth of the other."

Dr. C. L. Goddard. (*"Text Book of Operative Dentistry."*).—"Large teeth may be inherited from one parent and small jaws from the other, and thus produce an irregularity of some kind."

Dr. Milo Hellman.—(*Dental Cosmos,* September, 1914, *"A Study of Some Etiological Factors of Malocclusion."*).—"The influence of heredity, although acknowledged by many authors in relation to orthodontia, and again refuted by others has up to the present time not been considered with any sufficient degree of accuracy, and as yet remains an enigma so far as it relates to the problems of malocclusion of the teeth."

Attention has been called by Dr. Nord in an article read before the Society of Holland Dentists to a few citations taken from an article by Carl Röse which was published in the *Dental Cosmos* of November, 1912. The citations are as follows:

CITATION FROM CARL RÖSE'S ARTICLE.

"It is undoubtedly true that we modern dentists, in the same way as the medical men, benefit the living individual, but check the sound development of the race, unless we combine all our energy to become also the guides of civilized humanity in the field of the hygiene of nutrition.

"Unless we learn from history, and with all our energy resist the increasing degeneration of the race, it will not take even four hundred years, perhaps, until in Stockholm a Tartar chief, in Berlin and in Paris, Asiatic vice-kings reside, while perhaps in Washington a negro or mulatto is enthroned as President.

"Relentless war against the increasing hyper-refinement of life, return to a simple and natural mode of living,—that must be our dental slogan,—lest we knowingly cooperate in the destruction of modern civilized humanity.

"Disregarding a few occupational diseases, such as confectioners' caries, tooth decay is not a disease in itself, but as cannot be too strongly emphasized, simply a specially plainly visible symptom of general physical degeneration,—the gauge as it were, to human health.

"For that reason we must think and act medico-biologically. Many a young girl with poor teeth would not, despite abundant financial means, be sought in matrimony, owing to her homely appearance, and would not propagate the predisposition to bad teeth, had we dentists not embellished her teeth. The most degenerate individuals with poor teeth must be prevented from marrying healthy mates with good teeth by most considerate, but none the less most firm, unyielding measures.

"It cannot be repeated often enough that bad teeth especially are, as a rule, simply a partial symptom of general physical degeneration. The most radical remedy would be, of course, to forbid such degenerates with specially poor teeth to marry, as is done with all other pronounced degenerates. Nothing is left but to appoint physicians and dentists as officials, as publicly employed

health inspectors. But even they would be unable to prevent the increasing degeneration and the ultimate doom of the white race, unless the public powers gave them authority to practice rational race hygiene, to prevent the propagation of the most seriously degenerate subjects by interdicting their marriage, and to inhibit the further progress of degeneration by the introduction of a rational hygiene of nutrition."

What Dr. Nord Has to Say.

Nord has the following to say in reference to Röse's Article:

"In Röse's article, again, emphasis is laid upon biology as a nucleus for his theory, but again no proofs are given for his statements, which consequently could not find ready acceptance.

"Suppose such an official as Röse recommends were appointed, and that he were to receive full executive power, then Röse would see no objection to applying extremely severe measures, without even being able to give proof of his theories upon which these measures are based.

"Inasmuch as the majority of our modern biologists disagree with Röse it would certainly be out of the question to propagate such measures when the theories on which they depend are considered generally as not only incorrect, but are rejected by the majority.

"It is peculiar how these subjects, and this applies to the entire question of heredity in dentistry, are treated, and positive views are expressed, without any endeavor being put forth to indicate on what proofs these views are based.

"In conclusion, and while the theory of selection, variability of the species, direct and latent heredity and environmental influences have not been taken up and discussed in a systematic order, it is convincing that variability exists in every living being according to hereditary tendency; the useful varieties are favored by natural selection. Latent transmission no doubt is an important part of heredity, while environmental factors are of no influence upon the heredity germs."

A CASE OF NEUTROCLUSION, COMPLICATED BY EXTREME DISTOVERSION OF THE UPPER CENTRAL INCISORS, AND REDUNDANCY OF NUMBER

By Urling C. Ruckstuhl, D.D.S., St. Louis, Mo.

THE history of this case is characterized by neglect on the part of the parents and child. The patient was a boy of thirteen years, unusually large and well developed for his age. At the time he presented himself for treatment both lower first permanent molars were decayed to the gum margin, and there were large perforations through the pulp chambers, making extraction necessary. Upon inquiry I learned he had never made a practice of brushing his teeth. Between the upper central incisors were two cone-shaped supernumerary teeth which had caused the central incisors to erupt distally, and the lateral incisors had erupted

lingually to the centrals. Both of the upper deciduous cuspids were in place, and the permanent cuspids were erupting labially to them.

After thoroughly cleaning his teeth, plaster impressions were taken, and the decayed molars, deciduous cuspids, and the supernumerary teeth extracted.

Fig. 1.

Fig. 3.

Fig. 2.

Fig. 4.

After the models were finished, the extracted supernumerary teeth were pasted on the lingual surface of the upper model to preserve them, and they can be very plainly seen in Fig. 2.

Plain bands were constructed on the upper central incisors, and tubes soldered to the labial surfaces to permit the use of a horizontal threaded bar with a nut at each end. (See Fig. 5.) Patient was seen twice a week, and the nut

at each end tightened. As the teeth moved, the ends of the threaded bar were cut off. By applying the tension to these central incisors shortly after the supernumerary teeth were extracted, the bodily movement was much easier than if it had been necessary to move them through solid, healthy alveolar tissue. After a period of about thirty days the central incisors had moved bodily until

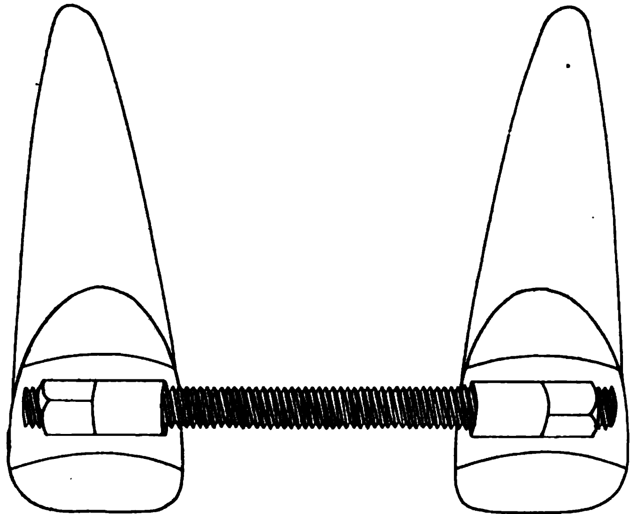

Fig. 5.

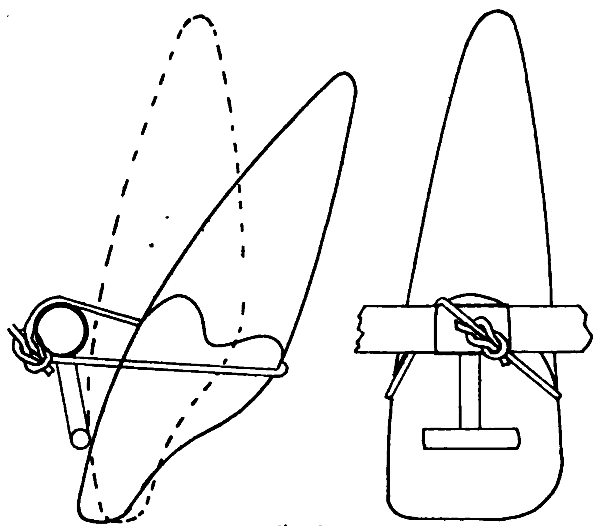

Fig. 6.

they were in contact. At this time molar bands were cemented to the upper first molars, and a plain alignment wire and silk-grass ligatures used to bring the laterals labially, and permit normal eruption of the cuspids. The labial movement of the laterals was considerable, and both of them tilted badly. An appliance was constructed, as shown in Fig. 6, which brought the roots out into position nicely, and by twisting the T-shaped end, any necessary rotation was easily accomplished.

The post-treatment appliance consisted of plain bands on the central incisors, with a lingual wire extending distally to hold the laterals in place.

This case, while somewhat unusual, should not be a difficult one to treat under normal conditions, but upon examining Figs. 3 and 4, it will be noticed that it is not what might be called a perfect result. After the first month of treatment the patient began to break appointments. It was a frequent occurrence for him to remain away several weeks between treatments, and when he did return, his mouth would show the evidences of neglect. Ligatures would be off, and particles of food wedged around the tubes on the molar bands. Once there was an interval of two months before I could get him back to the office for treatment. During this interval a ligature had slipped up under the gum around the left upper lateral, which resulted in death of the pulp of that tooth. I could never induce him to return to his dentist for treatment, with the result that the last time I saw him this tooth was slowly turning black. I finally dismissed him with the result shown in Figs. 3 and 4. While it is not a perfect result, he is not quite as badly off as he was before treatment.

GAINING AND KEEPING THE CHILD'S CONFIDENCE DURING ORTHODONTIC TREATMENT*

By Raymond L. Webster, D.M.D., Providence, R. I.

In our keen pursuit of knowledge whereby we may more accurately master the daily problems which confront us in our practice, we are quite apt to slight one which is very important, especially to us as orthodontists, namely, gaining and keeping the child's confidence. Just as we study the causes and treatment of each case of malocclusion which we are called upon to treat, so should we make a most careful study of the temperament of each child, thereby obtaining a perfect mastery over him and making the ofttimes prolonged work one of harmony both to the patient and to ourselves. Suffice to say that we very often need the magnetism of Moses, the patience of Job, and the wisdom of Solomon, but how can we develop these faculties? In the first place we must have the right attitude toward the little patient during our work with him and realize that even a little child is a person having rights, needs, and wants. In many instances, if we could for the time forget them as children and treat them as grown people, we would get along much better with them. The normal child is ready to observe and notice and reason and draw his own conclusions from everything he sees and hears, and while he may as yet be very ignorant and extremely credulous, just for these very reasons, if for no others, he puts us on our honor to be truthful and honest in all our dealings with him. So, at our first regular sitting, before we fill the patient's mouth with plaster, a moment spent in explaining just what this process is, showing him an impression previously taken and the pieces put together like a picture puz-

*Read before the Sixth Annual Meeting of the Alumni Society of the Dewey School of Orthodontia, Kansas City, Mo., February, 1916.

zle, arouses his interest and relieves any nervousness. Then, while the plaster is hardening in the mouth, and, if necessary, you are giving a quiet assurance that it will not choke him even if it feels that way (of course, using the mechanical precautions to back it up), a word spoken to him about noting that the plaster contracts and gets warm, awakens him to the fact that he is feeling these very sensations, that you know what you are talking about, and then he immediately starts to put his confidence in you. The assurance of seeing some nice white models of his own teeth at the next sitting sends him away with a keen interest to be on hand at that time.

At the treatments that follow, if the patient shows an interest in what is being done to his appliance, this interest can be kept by letting him watch you while soldering, etc. For those not interested, usually girls, a magazine with attractive pictures put into their hands with the understanding that it is to be put down when you return to the chair, passes the time without the development of uneasiness, and keeps the child's mind off of the clock.

Some men have or develop a faculty for telling stories to their younger patients. Sully cited a case of a boy who was listening with apparent impression to his mother's serious talk one day, but closed the colloquy with the observation: "Mamma, when you talk you don't move your upper jaw." Although this might be the result of some of our story-telling, yet if we held our hearer's attention as well as this mother did, we might consider our purpose achieved. Our work needs so much serious thought while the patient is in the chair that we usually have to omit any long narrations.

As the weeks go on and the patients get familiar with the surroundings, we may become companionable with them, but we must not let them take advantage of this attitude. We must preserve a certain amount of firmness and dignity if we wish to keep their respect. George Walter Fiske writes, "Never create a condition among those whom you try to help which you cannot make a permanent one," and I think this could apply to us.

With our smallest patients, they may unconsciously do some harm to our appliances, and we must not be cross to them, but explain to them, for ofttimes they do not know why what they did was wrong. With the older patients, the responsibility of the appliance can be put to a certain extent on their shoulders.

If a patient shows signs of discouragement in regard to the length of time that the appliance has been on, etc., we might give him a word of encouragement in something the same manner that a father did to his son. For years he had been scolding him for stooping, with no result, but one day he tried a new plan, and said, "Tom, what a magnificent chest you have."

Occasionally we have to deal with a child who has never had to mind at home and then our task is a little more difficult. When Johnson says that no class of men, even medical practitioners, are placed in so favorable relationship to these patients for the purpose of instilling into them obedience and stability of character as is the dentist, he shows us one of the greatest opportunities to do our part in developing true manhood and womanhood in coming generations. Government by word should be by means of fewest words possible, but these timely, decisive, cheerful, and not domineering, challenging

to obstinacy, or irritating to wrath. Sarcasm is a kind of word-discipline which should be pretty nearly abolished, for with it we are sure to lose the respect of the patient, and we must remember that personal loyalty makes willing obedience.

In closing, I wish to say that I have been prompted to choose this subject for my paper by remarks heard at different times. Many people have unpleasant recollections of the time spent during orthodontic treatment in past years, and while I realize that the science has so advanced since then that pain sometimes led them to make these statements, I believe that in many instances the practitioner had never mastered the proper management of his patients. Let us try to make our work more pleasing to our patients, and we shall surely find that the sense of satisfaction in the good attained is well worth all of the effort it requires to accomplish it.

American Illustrated Medical Dictionary (Dorland)

A new and complete dictionary of terms used in Medicine, Surgery, Dentistry, Pharmacy, Chemistry, Veterinary Science, Nursing Biology, and kindred branches; with new and elaborate tables. Eighth Revised Edition, Edited by W. A. Newman Dorland, M.D. Large octavo of 1,135 pages, with 331 illustrations, 119 of which are in colors. Published by the W. B. Saunders Company, Philadelphia and London. Flexible leather, $4.50, net.

Dorland's Medical Dictionary has long been accepted by the medical and dental professions as the standard book in its line. A great number of additions have been made to the different tables and the use of colored illustrations increases its value many fold. The work is quite complete so far as dental terms are concerned, although some of the more common orthodontic terms have been overlooked. The dictionary contains the words "orthodontia" and "dental-orthopedia," but does not contain the word "orthodontic" either as an adjective or "orthodontics" as a noun. The definition of the word "occlusion" is not given from a purely orthodontic standpoint, as we understand the word. Such words as "mesioclusion" and "distoclusion" fail to appear in the dictionary. These things simply emphasize the fact that a dictionary of dental terms should be edited by a dental man. As a dictionary of the medical sciences, we know of nothing equal to it, and we are sure the eighth edition will continue to occupy the high pinnacle in the medical profession that the former editions have enjoyed.

American Society of Orthodontists

The American Society of Orthodontists will hold their annual meeting in Pittsburgh, July 20, 21, 22, 1916. The usual high standard of the meetings of this society will be maintained. All those interested in Orthodontia are welcome. Any communications regarding the meeting may be addressed to Dr. F. M. Casto, 520 Rose Bldg., Cleveland, Ohio.

CURRENT ORTHODONTIC LITERATURE

EDITED BY H. C. POLLOCK, D.D.S.

Methods of Teaching Orthodontia to Dental Students

ORTHODONTIA as a distinct branch of dental study has had a place in the curriculum of dental schools of the United States for many years according to S. H. Guilford, A.M., D.D.S., Ph.D. (*Dental Cosmos,* March 1916). He says that at first it received only a limited amount of attention in its limited stage of development, but has gradually attracted more and more attention from both teacher and student.

In some schools orthodontia is taught by a special instructor dissociated from any of the more commonly taught branches, but in any event it has been found that the essential didactic teaching can be covered in about ten lectures of one hour each.

The practical instruction carried on in the college infirmary upon charity patients is usually extended over one or two entire college terms.

Plan of Didactic Instruction.—In the division of the subject so that it may be covered in the course of ten hours of didactic instruction, the following apportionment may serve as a guide:

(1) Definition of normal human dentition, including position and relation of the several teeth in each arch. This once understood, any deviation from it plainly constitutes an irregularity or malposition. The etiology of the condition, as far as we understand it, should also be included.

(2) Facial harmony and occlusal relation. It should be shown that orthodontia includes more than the readjustment or position of the crowns of the teeth so as to bring them into useful and harmonious relation, and that the position of the roots and adjoining alveolar tissue have to be considered, in order that the middle third of the face may be restored to its natural fullness and placed in harmony with the other features. Normal occlusal relation of the teeth in one arch with their opponents needs to be fully elucidated and pressed home, for any deviation from such normality constitutes a malocclusion of greater or lesser extent.

(3) Physiology of tooth movement. Changing the position of the teeth or the forms of arches necessarily involves changes in the soft and hard tissues affected by the movement. The character of such tissues and the changes they undergo, together with the understanding of the narrow dividing line between physiological and pathological change, needs to be emphasized.

(4) Dynamics. The various mechanical forces that may be employed in the movement of the teeth, their relative value, manner of employment, and proper regulation.

Materials and their use in the construction of appliances, together with the technic employed in such construction, should be given full consideration.

(5) Examination of patient and preliminary study of case. Taking impressions; model-making for further study and for record.

(6) Classification. Unfortunately, the different forms of malposition or malocclusion have never been classified in a way to be acceptable to all teachers or practitioners. There are as many different classifications as there are authors of text books on the subject, each having his own. Every teacher should therefore select the one which impresses him most favorably and employ it in instructing his classes.

(7) An exposition with enlarged and natural sized models, and appliances of the manner of treatment of each class of malposition.,

(8) Continued.

(9) Continued.

(10) Principles governing retention. Various forms and kinds of retainers, methods of construction, and the principles governing their operation.

Illustrative Sample Appliances and Models.—During the seventh, eighth, and ninth lectures the teacher should have upon his lecture stand a gigantic model of the upper arch and palate, about fifteen inches in diameter, with teeth of the manner of treatment of each class of malposition.
of suitable size placed in their sockets surrounded by modeling clay, so that their positions may be varied to illustrate the typical forms of malposition.

Enlarged regulating appliances are then placed in position and operated in a manner to bring the malposed teeth into normal alignment. By this means the teacher is enabled to reach the student's intellect through the medium of the eye more forcibly and directly than by verbal descriptions alone or by charts. The latter have their value, but experience has shown that the methods of applying force, and the actual movement of teeth in the enlarged model as seen by the entire class, convey a better idea to the student's mind than anything that could be shown upon the chart or blackboard.

Life-sized models of plaster of Paris, celluloid, or vegetable ivory, with natural size appliances upon them showing methods of correction, also serve a valuable purpose. These can be passed to the class for hasty examination during the lecture, or held for a more minute inspection at the close of the lecture hour.

While these illustrated lectures are delivered during both the junior and senior years, the manual or technic instruction in the construction and adjustment of appliances to a model of natural size should be begun about the middle of the junior year, or as soon as the professor has delivered his fourth lecture.

Technic Work.—The technic work should be in charge of a special instructor in a room properly equipped for the purpose, and all of the work of each student performed under his immediate instruction and supervision.

This course might well include drawing of wire in a drawplate; drawing strip of plate into tubing; forming metal bands to fit the different teeth, and various attachments soldered to the bands for convenience in applying force; threading wire and drilling and tapping nut to fit it; making wrench to fit nuts; making jackscrew and sleeve; joining wire by soldering; joining tubing at different angles; making piano-wire clips to hold parts during soldering.

After this course of practice in manipulative procedure, each student should be given instruction and practice in impression taking and model making.

Plaster impressions can be taken by students of one another's mouths, and from these models may be made and trimmed in an artistic manner. This practice will serve to familiarize them with the details of procedure, and lead to proficiency when the same operation is to be performed upon actual patients. Care and exactness must be exercised in every detail and each step inspected before the work is accepted.

Three hours a day for three days in the week for half a year should afford ample time to cover the course as outlined.

Clinical Experience.—During the senior or final year the student should be given clinical experience in orthodontia. All varieties of dental malposition and accompanying arch and facial deformity are to be found in the college infirmary during each college term.

All of these should be under the immediate direction of the instructor who has had charge of the technic course. The simpler cases may be assigned to students of lesser proficiency, and the more difficult ones to those who have shown special aptitude during their technic training.

Each case should be carefully examined by the instructor in the presence of several students, its clinical features pointed out, and the several ways in which correction might be accomplished discussed.

At such times it is well for the instructor to question the students about him as to their views in reference to the most advisable method of procedure. When their views indicate an intelligent perception of the salient features of the case, and a good understanding of the proper methods to pursue in correction, he should commend them, and when incorrect or faulty he should indicate wherein they have erred, either in diagnosis or proposed treatment.

When, after a full discussion of the case, a method of procedure has been decided upon, the instructor should assign the patient to one or two of the students, with instructions to begin the treatment. To aid them in their work it is well for the instructor to sketch upon a printed diagram—such as is found in all infirmaries for recording proposed work—the forms and kinds of appliances to be employed in the case.

The student or students who receive the case should then proceed to prepare the mouth for impression taking by a thorough prophylactic treatment, removing all calcic or soft deposits from the teeth and rendering them absolutely clean. At the same sitting, plaster impressions of both arches are taken, from which models are to be made. It will be found advisable to obtain two sets of impressions and models, one set to be used for the adapting and fitting of the parts of appliances as they are constructed, the other set to be retained for reference as the case progresses.

The time intervening before the following appointment is employed in the construction of the indicated appliances. Where the case has been assigned to two students conjointly, this work can be divided between them.

When the patient returns for the placing of the appliances, the instructor must be at hand to watch and direct every movement, but the actual work of

adjustment should be done by the students in order that they may thus gain the necessary skill and experience.

In some schools the instructor performs all the work of fitting and adjusting the appliances, while the students stand by and see it done, but in most schools it is considered more beneficial to the student if he is obliged to perform the work himself, even though it be at some sacrifice of the patient's comfort.

Similarly, at each succeeding sitting of the patient, the instructor should advise, and when necessary assist the student in his work, but as much of the responsibility as possible should be placed upon the student himself, so that he may gain the self-confidence which is one of the chief essentials of success.

Carried along in this manner, after the student has completed a few cases of malposition he will have gained as much practical knowledge of correction as can be gained in a college course, and be reasonably well equipped to conduct similar cases in private practice.

Dr. Edward H. Angle's Pin and Tube Appliance

IN discussing this appliance, Doctor A. H. Ketcham, Denver, Colo., (*Items of Interest*, March, 1916) considers the advantages and disadvantages, and shows many models and photographs.

Among the advantages, attention is called to the fact that results obtained are more nearly ideal in occlusion, with more nearly correct angles of inclination of the teeth.

There is better stimulation of development of bone surrounding tooth roots; better stimulation of development of the nose cavity, and less pain for the patient.

Then, too, visits of the patient are less frequent. Patients from a distance may be treated as readily and with as good results as those nearby.

Prophylactic advantages are of moment.

The operator develops greater technical skill, forming the habit of careful, scientific observation through weighing the effect of pressure exerted by this delicate appliance.

Among the disadvantages is the necessity for the operator who would use this appliance to the greatest advantage, to have special instruction from Dr. Angle or some skillful teacher who has had the benefit of Dr. Angle's instruction.

The technic of constructing this appliance is difficult, requiring the best efforts of even the most skillful operator. The eye and nerve strain is severe. The former may be reduced by wearing some form of prisms or loupes, while the latter is lessened as skill is acquired.

The expense and time required to construct this appliance is a disadvantage to the operator who has not developed his salesmanship sufficiently to prove easily that the benefit obtained by using this appliance is great enough to warrant the maximum fee.

Attention is called to the difference in principle of application of force between the old and the new appliances.

With the old expansion arch force is transmitted to the teeth through ligatures which must be tied tight. As soon as a tooth moves the ligature slips, irritating the gum and allowing back and forward movement of the tooth, inducing inflammation and soreness. With the new appliance, the force is transmitted without loss through a pin soldered to the arch. The pin accurately fits, telescopes and locks in a tube soldered to a band which is cemented to the tooth. By this means very gentle pressure may be employed, as all the force is transmitted to the tooth.

Dr. Ketcham cautions against the use of inferior materials in an attempt to construct these appliances. Located in Denver, which, like Los Angeles, every person who can afford to travel will sooner or later visit, he sees much of the orthodontia practiced in this country. He has been astonished to find that some orthodontists will use crude makeshifts which are lacking in strength, spring, delicacy, and the high percentage of precious metals which are contained in the appliances as developed by Dr. Angle. These appliances are manufactured by a firm which has spent thousands of dollars in perfecting machinery to produce them with the greatest degree of accuracy and at the minimum cost, and whose metallurgist is spending much time to perfect the precious metal alloys used.

This accuracy in material used by the orthodontist helps in the accuracy of his work, and when he says he is using Angle's new appliances, but is only using imitations, he is deceiving his patients. It is impossible to secure as good a result and carry on the treatment with as little pain and discomfort to the patient. Besides, the operator with crude appliances deceives himself, because he is obliged to spend more time upon a case.

An Ode to an Orthodontist

By His Patient

To a bad orthodontist
I write this little poem,
To tell him what I think of him
In a made up nursery rhyme.

Oh! Doctor Weeks, most cruel,
How could you lie so much?
You said you would not pull my tooth
And other tales as such.

You were only going to fix my arch,
You would not touch my tooth
Oh, No! Oh, No! it was not so,
My tooth was out, forsooth!

I was so shocked, I could not think
Of anything to say,
Except that I was so surprised
That he should lie that way.

"You must have pulled that out yourself
Before you me did see;
Or was it Doctor Houson
That did that job for me?"

"Oh, no!" I said, "'Twas Doctor Weeks,
That did that job so cruel."
He then did have to set about
And gather some more fuel.

To set his thinking furnace
A-going, don't you see?
He thought a while, and then did make
A slight remark to me.

"I haven't anything to pull
A tooth with, so I'm 'fraid
You'll have to lay the blame on Doctor Houson
Or yourself, my little maid."

Moral

And after this when orthodontists
Fuss a good deal with one tooth,
I shall just shut my mouth up tightly
And say, "I'll keep this tooth."

—*Elizabeth Whitney.*
Saginaw, Mich.

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EDITORIALS

The Attitude of the Dental Profession Toward Orthodontia

WE have had something to say several times in regard to the need of a more intimate relation between the practitioner of orthodontia as a specialty and the general dental practitioner. In times past many unkind things have been said by the dentist about the orthodontist, and likewise the orthodontist has made uncomplimentary remarks about members of the dental profession. That there exist more or less differences between the orthodontist and the dentist must be apparent to anyone who is acquainted with the condition. There are several reasons for these differences, and in some cases it is the fault of the dentist, while in other instances the orthodontist is to blame. The general practitioner often accuses the orthodontist of being narrow-minded, of refusing to give instruction in phases pertaining to orthodontia, and of declining to help the dentist treat the simpler cases of malocclusion. In some instances this is true. Those who have been practicing orthodontia for a considerable time will probably remember various occasions when papers have been read by

orthodontists before dental societies where empty seats predominated. In other words, the general dentist has not been sufficiently interested in orthodontia to pay much attention to papers on that subject. We have occasion to call attention to this matter at the present time because of two circumstances brought to our notice. The first is the arrangement of a joint program by several dental societies for a dental meeting to extend over a week, where, in looking over that program, we find that the subject of orthodontia is conspicuous by its absence. We have in this case a committee that arranged for a dental meeting which will probably be larger than any other meeting held this year, excepting that of the National Dental Association, and not a single clinic or paper on orthodontia during the entire week. The second circumstance is that the National Research Committee of the National Dental Association has investigated, or is investigating, practically every problem in the dental curriculum excepting problems pertaining to orthodontia. There probably have been more original investigations conducted by orthodontists in the past ten years than have been carried out by any other branch of dentistry. Of course the excuse for this is an old one—that the dental profession is not interested in orthodontia; but, if not, why not? It seems rather unfair that orthodontists in the United States should be called on to contribute to the funds of the National Research Dental Committee and then have their science ignored by this committee, and have the subject of orthodontia treated as if it were not entitled to any consideration.

The Question of Priority

OF the various problems with which orthodontists have to contend, there probably is no other one question which has caused so much discussion and on account of which so many friendships have been wrecked as the question of priority. It has been the aim of most scientific writers to be careful to give credit to whom credit is due, but it is sometimes difficult to determine who did a certain thing first. It is well known that at the present time the dental profession is divided on the matter of a process, in which case a certain person claims he developed the process first and obtained a patent for the method. He may have been entirely honest in his opinion as to being the originator, but it has been proven beyond a doubt that many persons followed the same process for years before he obtained his patent.

It occasionally happens that credit is given to an individual for an improvement, only to learn afterward that some other person has used that improvement in previous years. Orthodontic appliances have been greatly improved during the past ten years, and are much more efficient now than they were formerly, but there are nevertheless two certain mechanical principles present in all regulating appliances—the screw and the lever. The successful application of the modern appliance depends on the effective force to be derived from the screw or the lever. The use of the loop either alone or in conjunction with the screw is but a form of the lever or spring force.

We recently felt called on to consider the question of priority with special reference to the loop appliance, as *The International Journal of Ortho-*

dontia has published two articles concerning this appliance, with the result that we have received letters from various persons questioning our conclusions. It has been claimed that one article, at least, committed a grave breach of etiquette by not giving priority of the use of the loop appliance to different individuals. We therefore decided to examine the dental literature and ascertain if possible who was the first to use the loop as a means of increasing the efficiency, by improving the range of movement or the application of force, in their regulating appliance. We have written to several persons as to when and how they first used the loop, and, as is to be expected in a case of this kind, not one seems to have a very definite idea as to when he first made use of the appliance, but it is fairly well established that the loop was introduced by what is known as the Ainsworth regulating appliance as designed by Dr. Ainsworth, of Boston. The loop was used very early in modern orthodontia by Dr. Varney E. Barnes, of Cleveland, Ohio, in connection with the Barnes power tube. We find that a manufacturer of orthodontic appliances about ten years ago designed a pair of pliers for the formation of the loop, and manufactured appliances which were fitted on the model, embodying the principle of the loop. Of course, the loop, as used at the present time to supersede the screw, involves greater use than formerly. After careful consideration, however, of all the obtainable data concerning the use of the loop appliance, it is our opinion that none of the present claimants for priority of the principle involved are entitled to that distinction.

The Personality of the Dentist

THE personality of the dentist, particularly that of the dental specialist of today, is the pivot around which his general conduct to a greater or less degree revolves. By the term personality we must necessarily include more than pleasing manners, a gentle rearing, and kindly disposition. The dentist's personality should embrace several conspicuous characteristics which, taken as a whole, produce a character with strong inherent traits, added to which must be a refinement that is not acquired in a dental education as a part of the curriculum, but which can be developed by the ambitious dentist from a study of older and well-trained practitioners who have been broad enough to develop along more than one particular narrow path.

The mental and physical phases are of prime importance. A professional man should cultivate a well-balanced mind. He should be of strong mental caliber, unswerving in his deductions if he is assured of the ground on which he stands, and not be influenced by mere caprice or by persons whom nature has endowed with a dominating personality; nor should he, to use the vernacular, be "bluffed" by persons whom he knows not to be qualified to form an intelligent opinion on the subject at issue.

If at any time a professional man is judged by his personal appearance and action, it is when a new patient enters his office for the first time, for on such occasion he should present a certain degree of calmness and self-possession, which inspires confidence, the same as does a well-modulated voice. Composure, and yet a pleasant manner, possesses an asset that is invaluable to the

man who expects to be consulted by people who demand the best that science has to offer.

The professional man of today, if he is to advance, must be not only thoroughly qualified in his professional ability, but should also strive to be modern in his social accomplishments, and he should develop those qualities which are characteristic of a successful social and business career.

First University Dental School in New York for Columbia

REALIZING the importance of the teeth and mouth infections to systemic disease, the Faculty of the College of Physicians and Surgeons have unanimously voted in favor of the establishment of a dental department, to be connected with the medical school. A committee of prominent dentists of the city have presented plans to the Medical Faculty which have been approved.

The school of dentistry will be closely associated with the medical school and the admission requirements will be the same as the medical. The course will be four years, the first two years the same as those in medicine, thus giving the dental student a thorough knowledge of the fundamental sciences necessary to the practice of a specialty of medicine. At the end of the second year the dental student will give all his time to the study of dental subjects, namely, operative dentistry, prosthetic dentistry, oral surgery and oral pathology, orthodontia, etc., and the more technical part of the work required for the well trained dental surgeon. This new school will be the first university dental school in New York City and the second in the State. It will give the first four year course of dentistry ever given in the Empire State.

Research Institute of National Dental Association

The Research Institute of the National Dental Association was incorporated June 24, 1915. It occupies two large residences on Euclid Avenue, Cleveland. Its first report includes lists of directors, members, etc., and of problems begun or contemplated. Among these are systemic diseases resulting from oral infections, such as various joint diseases, iritis, nephritis, gastric and duodenal ulcer, glandular infections, pneumonia, pyorrhoea, dental caries, the brown stain of teeth, whose cause is entirely unknown, a platinum substitute (dentists using one-third of the world's production, valued at 2½ millions), filling of infected roots, oral bacteriology, salivary disorders, facial deformities, relation of ductless glands to dentistry, *orthodontia*, are included. Special research rooms will be available for visiting dentists. If this last item means that facilities will be offered to the profession generally, without special influence or appointment, it is not only of value in itself but as a precedent to similar medical institutions.

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ORIGINAL ARTICLES

THE FACTOR OF HEREDITY IN MALOCCLUSION

BY DR. ARTHUR ZENTLER, NEW YORK CITY, N. Y.

Consulting Orthodontist to the National Association for the Study and Education of Exceptional Children.

WHEN applying to orthodontics the modern system of diagnosing by exclusion of suspected causative factors, which is adopted in obscure pathological conditions, one finds in several offspring of the same parents, the same or almost the same abnormal conditions, such as lack of arch development, malalignment, retarded retention of deciduous teeth, etc., it must be plausible that it is not likely that the various offspring have indulged in the same perverted habits, and that these were the initial causes, "the original etiologic factor," of the existent deviation from the normal.

Why should one assume, for instance, that two children, born ten years apart, as shown in the first case illustrated below, have indulged in the same habit which might create an abnormality, when it is fair to assume that had such a habit brought on the abnormality in the older child (a girl in this case), the parents would have surely tried to interfere with the creating of a similar habit in the second child (also a girl) born ten years later, and at a time when the result of this presumable habit, which played such havoc with the teeth and face of the first child, was quite noticeable? When the full complement of teeth, expected at a given age, is found in such mouths, and therefore early extraction of permanent teeth can be excluded as a factor of the abnormality; when the history of the cases shows that, while there was premature extraction of some of the deciduous teeth (no accurate statement as to which could be obtained) in the older of the two children, no tooth whatsoever, neither deciduous nor permanent, was extracted (except deciduous teeth, when ready to shed) in the younger sister, and therefore premature extraction of deciduous teeth can also be excluded as the factor of this similar abnormality in at least one of the sisters, the younger girl, showing thereby more conclusively that the abnormal-

ity in the younger sister existed despite the lack of extraction, there is no reason to conclude that extractions of deciduous teeth have produced it in the older sister; furthermore when in the same case a facial deviation from the normal (surely correlated with the oral abnormality), such as a continuous diminution of the opening of the nares, was in progress in the older sister until, at the age when the casts were obtained, the nostrils were almost closed, and that a similar condition is found to be in progress in the younger sister, is there any valid reason to assume that "perverted habits" have been at the bottom of all these troubles, and is it not more reasonable to admit that something further back, perhaps in uterine life or even before that, something inherent in one or the other parent and transmitted to the offspring, has caused abnormalities of the same type in several offspring?

I am, of course, aware that other factors such as artificial feeding during infancy, adenoidal vegetations, hypertrophied tonsils, etc., may produce abnormalities and that it may be contended that even if "perverted habits" have not caused the same, it must not necessarily be concluded that heredity is the factor. One must however not lose sight of the fact that aside from bottle feeding, to which is attributed a certain type of abnormality which I have especially refrained from including in this brief, feeling that it can be pointed out as a postnatal cause and as one tending to create a habit, the other above cited factors and many more of the same character are of such nature that if we look at them in the light of the knowledge obtained from the work on normal and abnormal development of Gudernatsh, Abderhalden, Cotronei, Romeis, and others, showing the effects of lack or abundance in thyroid or thymus secretion and other ductless glands upon growth and differentiation of the species, we may well ask ourselves whether these very factors, held responsible for the abnormalities, are not themselves due to some lower or higher power of proliferation, of the original cell creating the tissues involved, inherited from a parent lacking or abounding in some of the mentioned secretions, and transmitting this tendency to the offspring. In other words, if we are willing to concede that proper secretion of some of the ductless glands is responsible for proper calcium metabolism during pregnancy, and we are willing to concede that this governs the proper development of the osseous structure of the body *in utero*, we must admit that the jaw bones and teeth will be affected as part of the structure governed by calcium metabolism; further, if this is admitted, we must concede that the proper or improper functionating power of the glands governing calcium metabolism must be due to the quality of the parent cell and therefore is also inheritable, and hence even if proper growth was not influenced during intrauterine life and the abnormality begins to make itself noticed later in childhood or in adult life only, which is very rare, it still may be inherited, originally, in spite of the fact that some perverted habit might seem to have caused it. Especially must this appear true when the same type of abnormality is duplicated or triplicated in various offspring of the same parent.

To accentuate the truth that the theory of "perverted habits" is wrongly accepted in the etiology of malocclusion in preference to the theory of "prenatal causes," I am giving herewith some records taken from a number of cases observed by me.

I. A. Z. age 26 (Fig. 1a) is a married sister of F. S. age 16 (Fig. 2a), and in the casts of both sisters the lack of maxillary development is apparent, resulting in both cases in bilateral mesioclusion (Figs. 1a, 1b, 2a and 2b), associated in both cases with almost the same cusp malrelation, strikingly so on the right side (Figs. 1b and 2b).

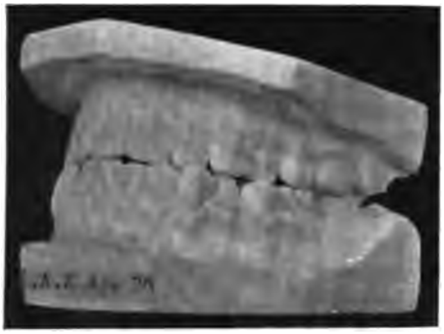


Fig. 1-A.

Fig. 1-B.

Fig. 2-A.

Fig. 2-B.

Fig. 3.

M. M. age 17 (Fig. 3) and B. M. age 25 (Fig. 4) two sisters, show linguoversion, the first of the lateral and the second of the cuspid on the left side of the maxilla, the other teeth being in fair alignment. Lack of teeth through extraction, in the mandible, prevents an intelligent consideration of the mesiodistal relation in these cases for purpose of comparison.

In a family of six children, three of them, B. W. age 17 (Fig. 5), S. W. age 19 (Fig. 6), and W. E. W. age 26 (Fig. 7), present to a lesser or greater degree the same unproportionate maxillo-mandibular relation seen, although not

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

very distinctly because of lack of too many teeth, in the cast of M. W. age 55 (Fig. 8), their father, whereas the other children while not having correct occlusion, are not afflicted with the same condition found in the father, and have

rather the arch relation found in the mother and of which I show the more pronounced case in M. W. age 21 (Fig. 9).

The idiosyncrasy of retaining until a late age deciduous teeth is also shown in two members of this family. In one, S. W. age 19 (Fig. 10), can be seen the retention at this age of the deciduous upper left lateral and left cuspid as well as right cuspid, the permanent left lateral and cuspid not having erupted, neither the permanent left lateral, while the permanent right cuspid is in linguo-torsoversion, and the Rœntgenograms of the parts showing no sign of the missing permanent teeth (Figs. 10a and 10b); in the other M. W. age 21 (Fig. 11), the lower right deciduous cuspid is retained at this late age in spite of the per-

Fig. 10.

Fig. 10-A.

Fig. 10-B.

manent cuspid having erupted, so causing the crowded condition which places the right second bicuspid in linguo-torsoversion.

In conclusion I wish to say that I do not care to go on record as claiming that all causes of malocclusion are prenatal, nor that perverted habits play no part in the etiology of malocclusion, but I am sure that too often "perverted habit" is accepted as a cause when it really is only the effect of a predisposition leading to that habit. Accurately obtained histories will show that almost always in cases of maxillary or mandibular anterior labioversion the desire of sucking the lower lip, in the first case and the upper lip in the second case, between the teeth was noticed later than the original existence of the anatomical

malrelation, and the persistence in the habit was due exactly to the effect of a spaçe, be this ever so unnoticeable in the beginning, existing between the upper and the lower teeth, which allowed the lower lip to be drawn up in the first case and the upper lip to be drawn down in the second case, between the teeth without any effort,—in fact this space acting as a comfortable resting point for the lower or upper lip, as the case may be. This persistence in the established habit creates now an adjuvant cause, which originally, as stated above, was the effect of a predisposition. To illustrate this I will take a case R. Z., a girl today three years and seven months old, which I had an opportunity to observe very closely, from birth on. As early as it was practicable,—at the age of two years and ten months, I obtained casts of the mouth (Figs. 12, 12a and 12b). I am sorry that I could not obtain casts earlier as the now existing labioversion of the upper centrals and mesio-linguo-torsoversion of the upper laterals and mesio-linguo-torsoversion of the lower centrals, leaving a general impression of a slight upper anterior labioversion, was noticeable to me long before the time when the casts were obtained, soon after the eruption of all the anterior deciduous teeth. The

Fig. 11.

child had a quite uneventful infant life, none of the infancy or early childhood illnesses, with the exception of lack of appetite, malaise, and temperature at the periods of tooth eruption, which almost all had to be aided by gum lancing, after which operation the temperature fell abruptly and the child returned to normal condition almost instantly. The child was entirely breast fed, never knew what a milk bottle or a nipple, hard or soft, was; took to the cup, for milk and other liquids, as soon as weaned from the mother's breast; was given solids, hard, dry toast, etc., as a goodly part of her diet as early as possible,—and in presence of all these extraneous aids for development of jaw-bone, presents a progressive upper anterior labioversion, surely in this case not brought on by the nipple of the milk bottle, and what is more to the point regarding the reason for which I am bringing this case as an illustration, only in the last half year or so, has this child acquired the habit of drawing her lower lip up between her teeth and of placing her thumb in the same place. She did not show the least tendency to these "perverted habits" before she was quite past three years, not until the space between her upper and lower teeth was quite more pronounced than is noticed in the casts shown.

The histories of other analogous cases being obtained by careful elicitation, trying as hard as possible to obtain accurate and truthful narratives, show similar sequence in the formation of the perverted habit presumably causing malocclusion. While some error might be claimed in the result of observation by lay parents as to whether the anatomical malrelation preceded the habit or *vice versa,* I am sure that at least in this one case described above (Figs. 12, 12a and 12b) there is no mistake; it was accurately and carefully observed by me. It may not be amiss to state in conjunction with this case and in support of the principles

Fig. 12.

Fig. 12-A.

Fig. 12-B.

upheld in this writing that I, the father of the child, show a labioversion of the upper anterior teeth, which were it not for the fact that several upper posterior teeth were extracted in childhood, would be a good deal more pronounced. Perhaps inheritance may by right be blamed for this analogy in father and child.

When the science of orthodontics will have definitely accepted the prenatal cause as an etiological factor in malocclusion, the most important work that is yet to be done in orthodontics, the preventative measures, will be given the attention rightfully deserved.

THE EVOLUTION OF THE PRINCIPLES OF APPLIANCES

By Joseph D. Eby, D.D.S., Atlanta, Ga.

Professor and Demonstrator of Orthodontia, Atlanta Dental College, Atlanta, Ga.

PART I.

When the science of orthodontia has been fixed, when the full knowledge of its divisions is completed, the crowning work will be the production of the ideal appliance.

This ultimate state will not be a memorial to one great mind, for such cannot be, any more than a structure can be more dependent upon the finishing touches than it is upon the first stone laid in its foundation.

The capstones of this great memorial—Perfected Orthodontia—will bear the names of the great leaders with justice and with the pride of all the profession, but supporting them will be the contributions of every other man who has ever separated any fact as a fixed part of the science.

In collecting the substance of this science from all of its branches, perfected orthodontia will embody the correct knowledge of those great histological and physiological factors to which every other phase must conform. The basic principles of normal development, normal occlusion, etc., which govern diagnosis, also etiology, nomenclature, with the other allied branches, are being rapidly perfected.

While there is a great field for further research, we have already attained the correct working knowledge of the physiological principles of tooth movement and bone development by mechanical stimulation.

It is through the intimate collaboration of these individually perfected parts that the specialist "feels" orthodontia, and is enabled through the mechanical means at our present disposal to effect the best results.

In considering the dynamics of tooth movement, it is useless to review the evolutionary processes through which this work has passed.

The question of stimulation vs. strangulation has been settled.

Even as the natural forces, abnormally applied, produce acquired types of irregularity by mild constant forces, so it is now universally recognized that the artificial stimulation of the bone cells demands a mild, constant pressure.

Too great significance cannot be attached to these two features, for physiologically correct tooth movement can only occur as the result of correctly applied, mild and constant forces.

In the study of the kinds of applied forces there are two which are subject to ideal control,—the spring and the elastic.

At present, nuts, ligatures, etc., are employed in conjunction for certain lines of tooth movement, but in the writer's opinion these means of traction will be entirely eliminated in the ideal appliance, replaced exclusively by the spring and the elastic.

In the ideal appliance must be found:

1. Stability of attachment. Inability of patient to remove appliance.

2. Greater resistance or a counter-control of resistance in the anchor regions against the sections of active movement.

3. Ability to control the teeth on individual paths of movement toward the normal, unless segments of arches may be similarly controlled collectively.

4. Susceptibility to reasonable alteration to meet advancing developments, although the delicacy or difficulty of construction should not be the primary consideration.

5. A mild pressure producing a stimulation of the osteoclast, which cannot be sufficient to effect the pericemental circulation or to bend bone or produce pain.

6. To be so adjustable in tightening that the exact degree of activity can be measured and controlled at regular tightening intervals.

7. A pressure so constant as to establish and maintain a uniform activity in the cells and to prevent the shocks which occur with intermittent forces.

8. To eliminate all forms of leverage such as produced by a one point of contact pressure against the crown of a tooth, to eliminate tipping of the teeth with no apical movement, which is required in the greater percentage of appliances.

9. An attachment which can produce bodily root movement in any direction required.

10. Cleanliness, freedom of contact against the soft tissues, and injury to the enamel.

11. To subserve, partially at least, for preliminary advantages, the correct principles of retention.

12. To be free from bulkiness and be inconspicuous.

The developments in regulating apparatus have sprung from two sources, "fixed" and "removable" appliances.

Both types, beginning in clumsy, uncontrollable, speculative designs soon presented two reversed conditions, i.e., in the "fixed" types stability of anchorage was gained at the expense of poorly and painfully applied forces, whereas in the removable types, the use of the mild, constant, painless, normally rapid stimulus of the spring was gained at the almost defeating expense of unstable attachment.

In realizing these facts, the greater number of designers of appliances determining that positive anchorage being the first asset, the removable types were condemned and their efforts were devoted to perfecting the kinds and lines of applied forces to meet this first requisite, viz., stationary anchorage and attachments.

Among our great pioneer scientists who espoused the "fixed" types and developed various designs of apparatus were men who contributed a great amount of work in founding the fundamental principles upon which the superstructure of orthodontia for all time will be based.

The work of these men and their followers has placed fixed appliances in the ascendency and caused a prejudice to arise against the removable types as a result of which, for years, the removable appliances were practically not recognized.

During this time, however, Dr. Jackson, recognizing the values of removable appliances, has developed his system which, after fifteen years of perfection in his hands, has proven to the world (in conjunction with the works of others) that the spring force properly controlled and anchored is the ideal means for

the transmission of mechanical stimulus to produce cellular activity, without any shock, injury or pain, and subservient to the correct principles of physiological processes by which tooth movement is effected.

Much has been written on the advantages of "fixed" and "removable" appliances and *vice versa*. These articles have been written mainly in the defense of the one type or the other, dogmatic conclusions have predominated, also a general unwillingness to admit the disadvantages of either.

Despite these positions taken by the champions of the different systems, the indomitable advance of science is gradually blending the best qualities of all methods into a new type of apparatus which will be neither "fixed" nor "removable" but will be almost equally dependent in theory, fact and credit to the two old classified forms.

These new appliances, whether they resemble the old "fixed" or the old "removable," are essentially fixed-removable, and out of this new era which we are just approaching will eventually be evolved the ideal methods.

Let us compare not the advantages vs. the disadvantages of the two types but instead the relative advantages and disadvantages.

Fixed Appliances.

Advantages.—Security of attachment to the malposed tooth. Control of individual tooth movement. Firm anchorage or a resistance to overcome the applied force which may be intramaxillary or intermaxillary. Appliance of small bulk and located in part of the mouth which is least sensitive. *Disadvantages.*—Uncleanly and injurious to both hard and soft tissues. Forces of screw and ligature are tightened to maximum pressure and diminish maximum force; has an intermittent and limited use of spring force. Liability of displacement of anchor teeth in all directions. Danger of tipping teeth. Very conspicuous.

Removable Appliances.

Advantages.—Cleanliness. Employment of spring force, which is mild, constant and painless; has great range of application and produces movements which are normally rapid and physiologically correct. Readily subject to alterations to meet advance developments, anchorage easily obtained to overcome the resistance of the malposed teeth. Adaptability of designs to meet all conditions. Inconspicuous. *Disadvantages.*—Insecure attachment. Difficulty in control of individual tooth movement. Danger of tipping teeth.

In recognition of these relative facts, the two types are now undergoing changes, the new attachments and designs of both types of appliances are fixed in anchorage, although removable, so as to employ the spring and to reduce the use of the screw and ligature,—thus have they become fixed-removable.

In the creation of this new type of appliance by combining the advantages and eliminating the disadvantages of the fixed and removable, we have reached the point where the future is to be devoted to the perfection of style and design, to balance out the requirements and practical application. This epoch through which we are passing will leave history to record the fixed appliance and the removable appliance, giving them equal credit for their great contributions to their successor, the fixed-removable.

(*To be continued.*)

FACE FACTS

A Clinical Study of Dento-Facial Deformities

(Continued from page 138)

By B. E. Lischer, D.M.D., St. Louis

Professor of Orthodontics, Washington University Dental School

A SUPERFICIAL survey of the existing varieties of man probably favors the acceptance of *the principle of endless deviation,* but it is worthy of note that recent advances in the science of anthropology continue to support the doctrine of *"the fundamental unity of the human species."*

"Race," says Topinard, "in the present state of things is an abstract conception, a notion of continuity in discontinuity, of unity in diversity. It is the rehabilitation of a real but direct unattainable thing."

Using the word *race* in this sense, Ripley maintains that "there are three ideal racial types in Europe—the continent of all others wherein social phenomena have attained their highest and most complex development." The present varieties of man in Europe have sprung from these three types, known as the *Teutonic, Alpine* and *Mediterranean* (Fig. 13).

The Three European Racial Types

RACE	HEAD	FACE	HAIR	EYES	STATURE	NOSE
1. Teutonic	Long	Long	Very Light	Blue	Tall	Narrow; aquiline.
2. Alpine (Celtic)	Round	Broad	Light Chestnut	Hazel Gray	Medium Stocky	Variable; rather broad, heavy.
3. Mediterranean	Long	Long	Dark brown or black	Dark	Medium Slender	Rather broad.

"They are not radically distinct seeds which, once planted in the several parts of Europe, have there taken root; and, each preserving its peculiarities intact, have spread from those centers outward until they have suddenly run up against one another along a racial frontier. Such was the old-fashioned view of the races, in the days before the theory of evolution had remodelled our ways of thinking—when human races were held to be distinct creations of a divine will. We conceive of it all quite differently. These types for us are all necessarily offshoots from the same trunk. The problem is far more complex to us for this reason. It is doubly dynamic. Upbuilding and demolition are taking place at the same time. By our constitution of racial types we seek to simplify the matter—for a moment to lose sight of all the destructive forces, and from obscure tendencies to derive ideal results. We picture an anthropological goal which might have been attained had the life conditions only been less complicated."

IV. Abnormal Facial Types

Sundry normal variations of the head have already been briefly described. All of the facial features thus referred to are equally subject to *abnormal varia-*

Teutonic type (Norway). Pure blond.

Alpine type (Austria). Blue eyes, brown hair. Index 88.

Mediterranean type (Palermo, Sicily). Pure brunet. Index 77.

Fig. 13.—The three European racial types. (After Ripley.)

tions of form and structure. The most obvious examples of maldevelopment of the head are the *microcephalous* and *hydrocephalous* crania of idiocy (Fig. 14). The eyes, ears, nose, teeth and jaws are frequently deformed in such cases; asymmetry is so common that it becomes the rule.

In his work on *"Plastic Surgery,"* Kolle adopts the following classification for deformities of the auricle, eyelids and nose:

Auricle.—Microtia, Macrotia, Polyotia and Malposition of the auricle.

Eye-lids.—Ectropion, Epicanthus, Ptosis and Ankyloblepharon.

Nose.—Superior, middle or inferior third deficiency; Superior or inferior half deficiency; Total anterior deficiency; Lobular, interlobular and subseptal deficiency; Alar deficiency (unilateral and bilateral).

But the principal purpose of these papers is to analyze some of the more minute details of certain types of dento-facial deformities which are entirely

Fig. 14.—Microcephalic and hydrocephalic heads; female 28 years, male 8 years old. (After Krukenberg.)

ignored by investigators lacking orthodontic training, and which are frequently underestimated even by orthodontists.

A common anomaly of facial expression, due usually to malposition of the incisor teeth, is shown in Fig. 15. Of course there are many variations of this form of abnormality, differing in degrees from that of very slight malposition of the teeth and barely recognizable *abnormal function of the lips,* to that of extreme malposition of the teeth and *material malformation of the lips.* Not infrequently the adjacent alveolar process is involved, for it is obvious that a crowded dental arch necessarily implies an arrest of development in the supporting structures.

On the other hand, the malocclusion of the teeth may be of a type where the deviations from normality are more symmetrical, therefore less evident externally. Fig. 16 represents a profile of this type with *normal lip function,* though the form and relations of the lower lip and mentolabial sulcus to the other features

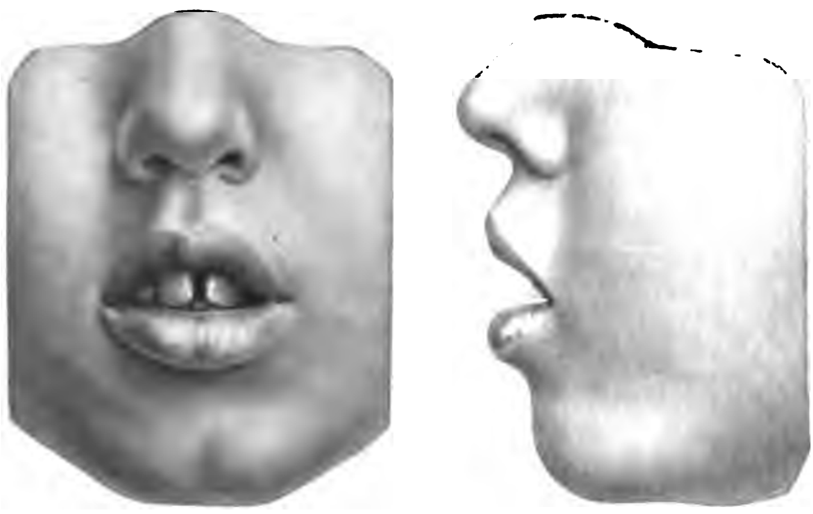


Fig. 15.—Shows abnormal function of the lips, due to malposition of the incisors; male 10 years old.

Fig. 16.—Shows malrelation of the lower lip to the upper, and abnormal mentolabial sulcus, due to distal relation of the lower arch; male 14 years old.

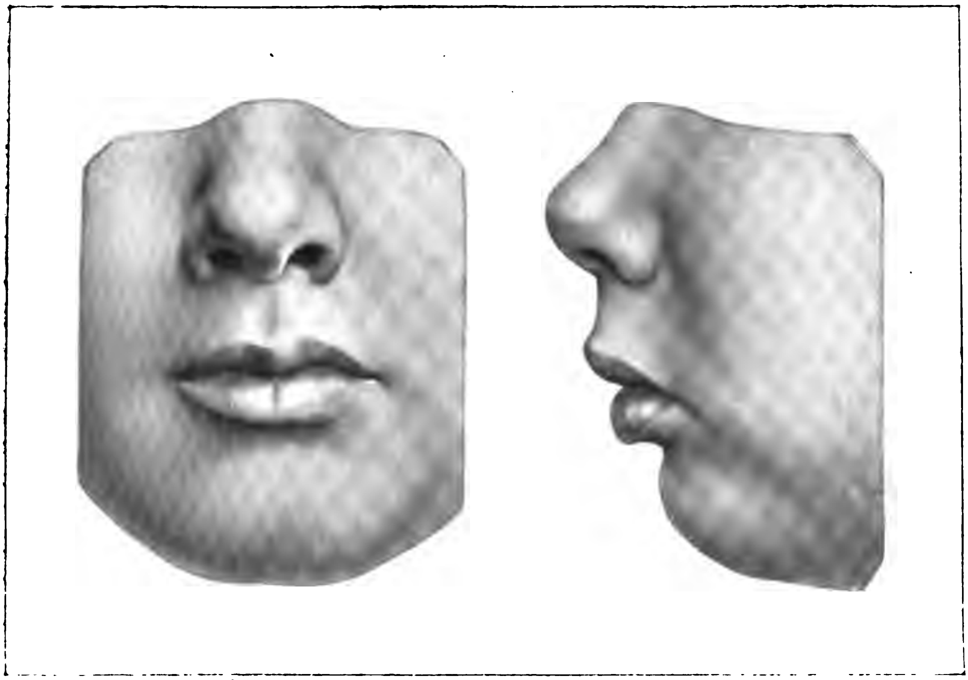


Fig. 17.—Deformity due to malposition of the mandible; the distoclusion of the lower arch is merely a symptom; male 11 years old. Compare the chin with that of Fig. 16.

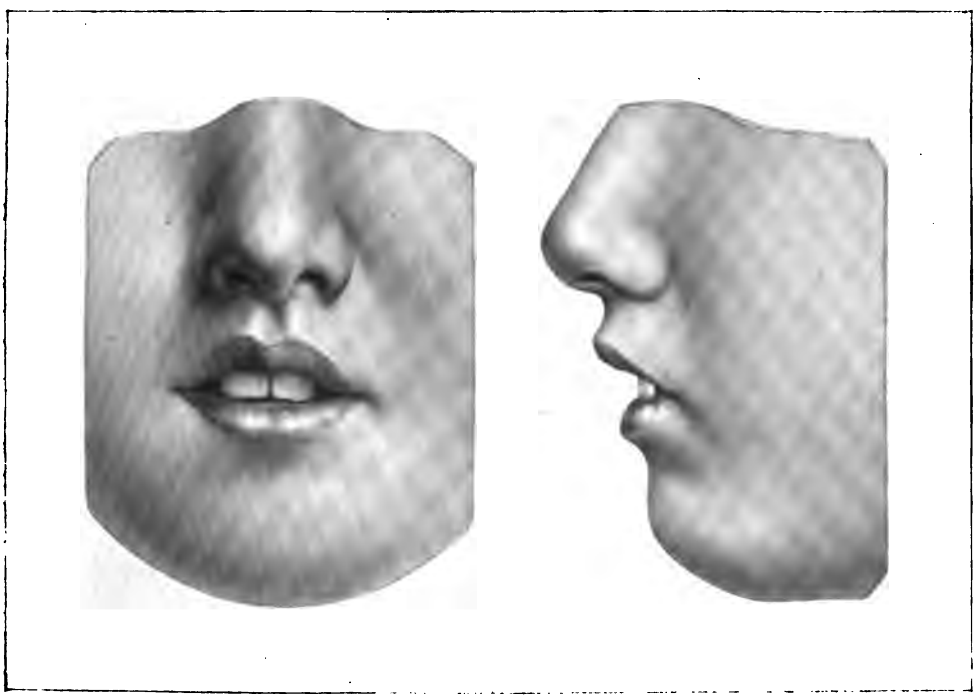


Fig. 18.—Shows malformation of the lips; note especially the extreme deficiency of the upper lip; female 13 years old.

are decidedly abnormal. This is due to a distal, or posterior, *malposition of the entire lower dental arch on its osseus base,* i.e., the mandible or lower jaw.

Deformities belonging to this group also vary considerably, passing by almost imperceptible gradations into that extreme type of facial malformation wherein the ascending rami of the mandible are too short, resulting in a posterior *malposition of the mandible* (Fig. 17). Such deviations will be considered in detail in subsequent chapters. For the present, the writer merely wishes to emphasize the normal function of the lips in this type, though it is combined with malrelation of the lips, a decidedly abnormal mentolabial sulcus and extreme deficiency of the mentum, or chin.

Fig. 18 presents still another type of deformity where, besides abnormal function, we have a marked *malformation of the lips.* Note the extreme deficiency in the length of the upper lip, due, in all probability, to prolonged abnormal function. Such extreme arrest of development is quite common, and if treatment is postponed beyond the developmental period its correction is exceedingly doubtful, if not impossible. The alert diagnostician is ever vigilant and strives constantly to prevent postponement in such cases.

A more comprehensive analysis of the various facial deformities due to abnormalities of dentition, emphasizes the necessity of a thorough understanding of the *anomalies of dentition.* It becomes desirable, therefore, to give an outline of them before proceeding to a critical study of their *pathology, facial types* and *prognosis.*

V. Abnormal Dentition

The denture of man is a complex mechanism composed of many parts. Unfortunately, it frequently presents abnormalities and malformations which seriously affect the efficiency of the teeth, as well as the harmony of facial expression, the functions of breathing, and of articulate speech. Anomalies of form, of number and of eruption of the teeth are quite common, and complications due to abnormalities of the nasal tract and accessory sinuses, anomalies of the temporo-mandibular articulation, maldevelopment of the tongue and general facial musculature are not infrequent.

But there are *four fundamental deviations from normality* which conjoin in a wide variety of ways in malocclusions of the teeth, so that most writers now recognize their basic significance. These four conditions are: *malposition of the teeth, malrelation of the dental arches, malformations of the jaws and their processes, and malposition of the mandible.*

In describing the normal variations of dentition the writer called attention to the normal variations of alinement of the teeth (Broca). This arrangement of the teeth in the form of two parabolic curves within the alveolar processes of the jaws is called *alinement.* When a tooth deviates from the ideal line of its respective arch it is said to be in *malposition, or malalinement* (Fig. 19). Normal position of each individual tooth is a very fundamental property; it conditions its normal function.

When the lower teeth of an individual are brought into normal contact with the upper, it will be found that the inclined planes of their occluding cusps adjust themselves very accurately. This ideal relationship between antagonists

Fig. 19.—From casts of two upper dental arches showing alinement and malalinement.

Fig. 20.—Occlusion and malocclusion, buccal aspect.

Fig. 21.—Nonocclusion, front view.

Fig. 22.—Occlusion of the permanent teeth of man, buccal aspect. (After Turner.)

Fig. 23.—Occlusion of the permanent teeth of man, lingual aspect. (After Turner.)

is termed *occlusion.* When a tooth is in malposition and hence, on closure, comes into abnormal contact with antagonists, we term it *malocclusion* (Fig. 20).

Occasionally, teeth are in such extreme malposition that, on closure, they fail to come into contact. We term this *nonocclusion* (Fig. 21). There are ten primary forms of malposition of the teeth and a multitude of possible combinations. The ten primary forms are as follows:

Labioversion—when an anterior tooth is labial to normal.
Linguoversion—when a tooth is lingual to normal.
Buccoversion—when a posterior tooth is buccal to normal.
Mesioversion—when a tooth is mesial to normal.
Distoversion—when a tooth is distal to normal.
Torsoversion—when a tooth is rotated.
Supraversion—when a tooth erupts beyond the plane of occlusion.
Infraversion—when a tooth fails to reach the occlusal plane.
Transversion—when two or more teeth are transposed.
Perversion—when a tooth is impacted and cannot erupt.

The various combinations of these ten primary forms of malposition are best expressed by combining the appropriate prefixes with the ending *version,* e.g., *torso- mesio- infraversion, etc.*

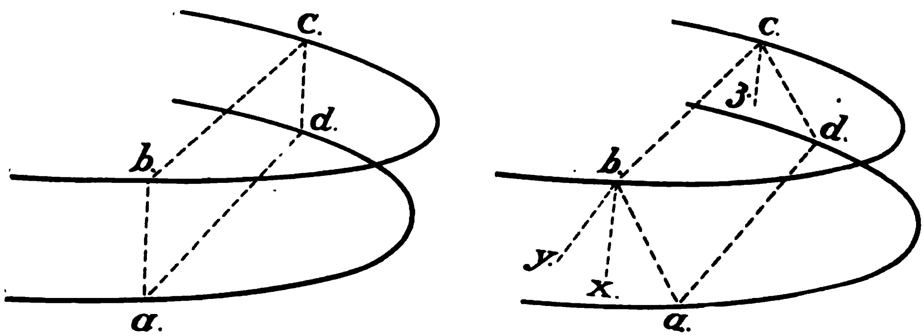
The harmonious arrangement of the teeth in the form of two arcades or graceful curves (an upper and lower, each with its right and left sides), demands a fine adjustment of the individual members of each arch if a symmetrical, well balanced ensemble is to be established. But when the teeth of man assume the normal, the resultant denture exhibits a symmetry that is truly wonderful (Figs. 22 and 23).

Bearing in mind that we are here dealing with *bilateral symmetry,* we can readily understand how all of the upper teeth, or all of the lower, could be in more or less perfect alignment in their respective arches, and yet, on closure, fail to come into normal occlusion. In other words, either arch (even though it retain a normal form) may be so displaced in its entirety upon its osseus base, that normal contact with antagonists is impossible. Figs. 24 and 25 are diagrammatic of such deviations. When the lower arch is mesial in its relation to the upper on both sides, and neither jaw is sufficiently malformed to warrant special designation, we term it a *bilateral mesioclusion.* If it is in mesial malrelation on one side only, we term it a *unilateral mesioclusion.* When the lower arch is distal in its relation to the upper on both sides, and neither jaw is sufficiently malformed to warrant special mention, we term it a *bilateral distoclusion.* If it is in distal malrelation on one side only, we term it a *unilateral distoclusion.*

The bony structures of the jaws beyond the teeth are at times so malformed that the malocclusions of the superimposed teeth are purely symptomatic of the deformity. In fact, *malformations of the jaws* are the most serious conditions we have to deal with; at times we meet with such extreme deformity that its correction lies outside the domain of orthodontics. I contend that when a case presents a pronounced malformation of one or both jaws, it is the very

acme of unreasonableness to ignore it. And our terminology should be such that the spoken word would convey to the mind of the listener a fairly adequate idea of the conditions under consideration.

Now it is obvious that malformations of the jaws may express themselves in several ways, i.e., as overdevelopments, or as arrests of development. Hence the term *macrognathia* and *micrognathia*. Clefts of the palate and curvature of

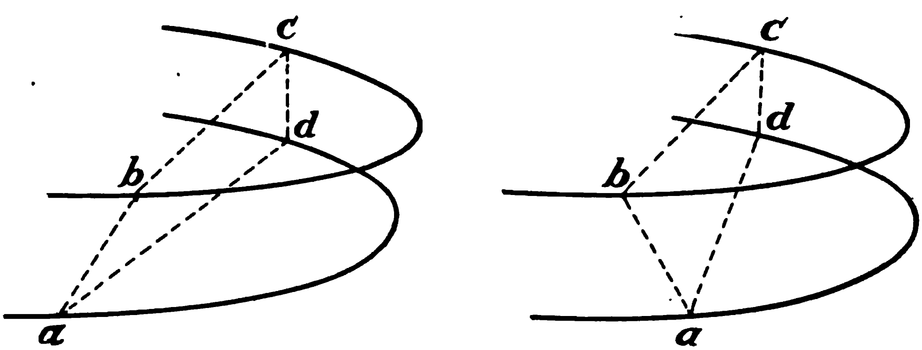


A B

Fig. 24.—Diagram *A* illustrates normal arch relationship. In Diagram *B*, the parallelogram *a*, *b*, *c*, *d*, illustrates arch malrelation in bilateral mesioclusion, and *b*, *y*, their relation in bilateral distoclusion.

the mandible are occasionally met with. Arrest of development in the rami of the mandible, and abnormal variations in its articular fossæ (which are not stereotyped or unchangeable), may cause *malpositions of the mandible* (Federspiel).

Fortunately, in a large percentage of cases, these more serious deviations from normality are entirely absent, or they are in the early stages of develop-



A B

Fig. 25.—Diagrams illustrating arch malrelations in unilateral distoclusion and unilateral mesioclusion.

ment and still amenable to treatment. But the following outline of dento-facial deformities is based upon the pathological manifestations briefly described above. For a more comprehensive argument in its favor the reader is referred to the writer's article on "The Classification of Dento-Facial Deformities" (*Interna-*

tional Journal of Orthodontia—Vol. 1, No. 6) and to the subsequent chapters in this series.

OUTLINE OF DENTO-FACIAL DEFORMITIES

Neutroclusion.—Simple and Complex.

Distoclusion.—Bilateral and Unilateral.

Mesioclusion.—Bilateral and Unilateral.

Maxillary Malformations.—Macrognathia, Micrognathia, Clefts of the palate.

Mandibular Malformations.—Macrognathia, Micrognathia, Curvature of the body.

Mandibular Malpositions.—Retroversion, Anteversion.

Tumors of the Maxillae.—Fibroma, Carcinoma, Sarcoma, etc.

Mandibular Ankylosis.

Polygnathia.

Agnathia.

(To be continued)

COMPROMISE TREATMENT, OR CONSERVATIVE ORTHODONTIA*

BY A. C. GIFFORD, D.D.S., OSHKOSH, WIS.

AFTER looking over articles published in the journals and books by eminent authors, and thinking of different subjects suitable for this paper, I could find nothing that treated upon what I have designated "Compromise Treatment." We find writings quite frequently upon types of cases upon which I use my so-called compromise, but they are all to be treated by a method that I do not always favor. Especially in those cases among our younger patients.

We read about moving the teeth back to their proper position, or back to where they should be normally, but nothing about bringing the teeth into approximal contact when a tooth is missing, which may be either congenital, or acquired by extraction.

When thinking of our teachings, we can think of only those cases coming under general plans of treatment, but, as we practice our chosen specialty, we find that there is a class of cases that can often be more properly treated in a more conservative manner. I find there are different conditions in different localities, especially as there are a great many general practitioners who do not seem to observe or know the orthodontic principles.

Where I advocate "Compromise Treatment, or Conservative Orthodontia" is in such cases as come under our care with missing teeth, and when patients apply to us for treatment during the growth of the bones of the face and jaws.

I do not think that all cases with missing teeth should be treated by the

*Read before the Sixth Annual Meeting of the Alumni Society of the Dewey School of Orthodontia, Kansas City, Mo., February, 1916.

compromise method for we must discriminate, especially so with patients past the age of bone growth.

When we find a tooth missing from a younger patient, be it either from congenital or an acquired cause, it is for us to use, not what I will call regular treatment, but what I have called "Compromise Treatment," and render our little patient what I think the most practical and proper dental apparatus.

In working out this form of treatment, you will come to certain conclusions that can be gotten only through practical work.

Fig. 1.—Right upper lateral incisor congenitally missing.

Fig. 2.—Right and left lower first molars missing, having been extracted.

Perhaps you can recall some case you have in your practice that has a tooth missing, it having been extracted, most always a first molar, and the other teeth have moved or tipped to find contact leaving very little space.

In my estimation it would not be a wise orthodontic procedure to try and regain that space and put in, or have put in, some artificial substitute to take the place of that missing tooth, thereby mutilating the teeth on either side of the space by mounting them with crowns or inlays for the purpose of placing a bridge, which, to my estimation can be nothing but unsanitary.

In the case of a molar, which is missing, you may say that a second molar

will not occlude properly with its antagonist, a first molar. This I will admit. but will it not occlude as well, and a great many times better than would some artificial molar? A second molar properly placed in the position that the first molar should occupy will make almost as good and serviceable a tooth as would the first molar and when the third molar erupts, it will take the place formerly occupied by the second molar, and be of some service.

As to the teeth which are missing from congenital causes, we will find

Fig. 3.—Front and side view, showing right upper first premolar congenitally missing.

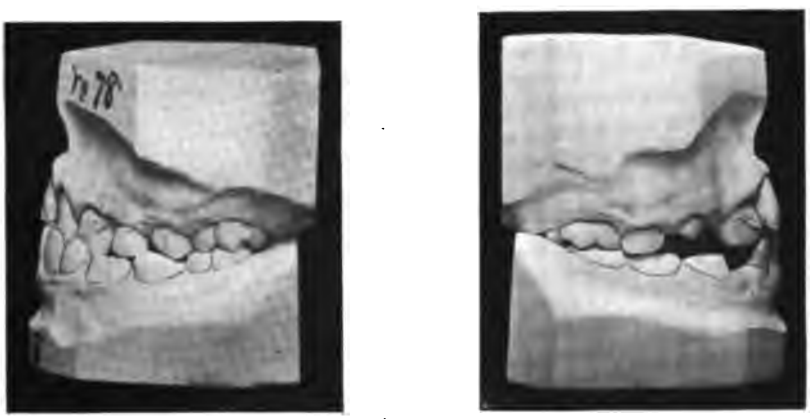


Fig. 4.—Right and left upper first premolars congenitally missing.

them to be mostly superior laterals, but, occasionally they may be premolars. When we find malocclusion associated with missing teeth, my plan is not to open the space that the missing teeth should occupy and make spaces for an artificial substitute, but to put the teeth into contact even though we do have to have a canine approximate a central, and have one side of the upper posterior teeth bite one cusp mesial to the normal. Would this not be a great deal less conspicuous than a porcelain tooth?

In order that I may demonstrate this a little more fully I have some illus-

trations that I will show you and explain my plan of treatment in this class of cases. However, I am sorry that at this time I cannot show you the finished results, but perhaps I can at some later date.

Now, if you will notice, the model shown in Fig. 1 has a right lateral missing, and the x-ray showed no tooth in the maxillary. Instead of moving the right lateral half to have the premolars bite normally, I left them as they were, and only moved the anterior teeth into contact. I believe that I am giving this young lady a better masticating apparatus than if I had made the space for the missing lateral, and had some conspicuous porcelain tooth inserted, and I have not mutilated the canine and central.

In Fig. 2 you will see that there are two lower first molars missing, having been extracted. The second molars have moved until they are almost in contact. This patient being but fourteen, I decided to move the second molars forward with the rest of the lower teeth, and when I am finished I expect to

Fig. 5.—Left upper first molar missing, having been extracted.

Fig. 6.—Both upper laterals congenitally missing.

have them in the position that the first molars would have occupied, or to take the place of the first molar in a normal position.

Fig. 3 shows a right first premolar missing from congenital causes, as there is no history of one ever being extracted, and the x-ray shows no tooth impact. This case is a very peculiar one, and I have tried to classify it, and the best I can do is to call it a Class I Angle. In treating this particular case, I had the left third molar extracted, and moved all the upper teeth on the left side (from central to second molar) distal to make the median line normal. I then took out an impact supernumerary tooth, shown at (X), and am now moving all the right upper teeth mesial without opening up the space in the first premolar region. I believe I will have a better appearing case when I am finished than if I had made a space for a premolar, and the tooth on either side will not be mutilated.

In Fig. 4 both of the upper first premolars are missing. There is no history of any extraction, and the x-ray did not show the teeth in the process. You will notice that the first molars are in their normal positions with the other teeth all in lingual occlusion. I believe the best way of treating this case is to move

the molars forward, so they will bite one cusp mesial to normal, and in this way take up the space of missing teeth. By so doing I will have the teeth all in contact, and will have no space to insert an artificial premolar. In my estimation, I have treated this case conservatively, and for the best welfare of the boy.

In Fig. 5 the first upper molar has been extracted. When I first saw this case, the roots of the tooth were present. Why should this space be retained when it is an easy matter to move the second molar into contact with the second premolar? I have moved this tooth into contact, but, as you see, this case needed considerable other work. I cannot show how nice a first molar this second molar makes.

The next and last case (Fig. 6) has two laterals missing. This case was referred to me to make some appliance to retain the space until this boy, now thirteen, was considered old enough to place a bridge to supply the missing tooth.

I came to the conclusion that this was a case where I could apply my compromise treatment, and I put this before the dentist who referred the case to me, with the result that I am now moving all the upper teeth forward just one cusp, or just enough so that the first premolar will be placed where the canine should normally be, and there will be no space left between the canine and central. Do you not think that I am doing what this boy should have? To wait until the boy was at least twenty years of age would have been necessary before the artificial laterals should have been placed and then those canines and centrals would have been mutilated.

I will say in closing that my paper might have been titled "Compromise Treatment vs. Artificial Substitution."

We find a great many cases of this class in our practice and I hope I have impressed you favorably with what I have surnamed "Compromise Treatment, or Conservative Orthodontia."

MODEL LIBRARY INDEX

By R. C. Willett, D.M.D., Peoria, Illinois.

VALUABLE statistics may be kept in the orthodontist's library if a little time is given to careful recording of a few numbers and dates as new models are made and placed in the Model Library Cabinet.

The writer has compiled a convenient index making practical use of Dr. B. E. Lischer's classification of Dento-Facial Deformities. To those who have made a careful study of Dr. Lischer's classification, it will readily be seen that it is the most complete that has been contributed to the science.

The loose leaf binder known as the DeLuxe price book No. 208 is used as an index book. The yellow, heavy bound index leaves are supplied with red leather margin tabs on which are stamped in gold letters the following abbreviations for the general divisions of the classification:

Neutroclusion	Neutro.
Bilateral Distoclusion	Bilat. Disto.
Unilateral Distoclusion	Unilat. Disto.
Bilateral Mesioclusion	Bilat. Mesio.

Unilateral Mesioclusion	Unilat. Mesio·
Abnormal Labium Frenum	Ab. Fre. Lab.
Malformation of the Jaws	Mal. of Jaws.
Miscellaneous	Misc.

The general divisions of the classification as given is then divided into such subdivisions as the orthodontist may consider essential to differential classification of dento-facial deformities.

The accompanying illustration shows the Model Index open. On the left side is an illustration of a typical case coming under that particular division. The page on the right shows in the first column the line number which readily gives the number of cases of that type entered for consultation or treatment.

Photograph showing model library index open.

The second column gives the filing cabinet number. The third, double column, gives the ages and dates of entry and the other columns show a date of additional model records as made.

The advantage of such an index as here described and illustrated is that an invaluable record of cases and differential diagnoses you have made is always at hand for ready reference and right up to the minute.

Only a brief outline of this index is given and that only in a general way, there being many essentials which will naturally suggest themselves to the experienced orthodontist.

THE HISTORY OF ORTHODONTIA

(Continued from page 117.)

BY BERNHARD WOLF WEINBERGER, D.D.S., NEW YORK CITY

JOHN HUNTER (1728-93), a famous physiologist and professor of surgery, initiated in England a new epoch of dental art, and through his scientific observations was able to change the old ideas and put dentistry on a scientific basis. Having been a surgeon-general in the English army, he devoted most of his time to the anatomical and physiological aspect of the science and later to the treatment of dental diseases. In his writings, the first scientific work on the subject, Hunter gave a very long and detailed description of all parts constituting the oral cavity and masticatory apparatus. He tried to establish a scientific nomenclature of the teeth; the words cuspidati and bicuspidati were originated by him. He was the first to dwell at length on the occlusion of the teeth. In one of his works is a drawing showing the front and side view of the teeth in

Fig. 1.—John Hunter (1728-93).

perfect occlusion (Fig. 2), and another showing the roots of the teeth exposed in their sockets (Fig. 3). It shows the relation of the upper and lower teeth, their overlapping and interlocking of cusps.

In speaking of the correction of dental irregularities in his work, *"Natural History of the Teeth"* (1771), he devotes three chapters to regulation of the teeth.

CHAPTER VI

Irregularities of the teeth.—As that part of each jaw, which holds the ten fore-teeth, is exactly of the same size when it contains those of the first set, as when it contains those

of the second; and as these last often occupy a much larger space than the first, in such cases the second set are obliged to stand irregularly.

This happens much oftener in the upper jaw, than in the lower, because, the difference of the size of the two sets is much greater in that jaw.

This irregularity is observed almost solely in the incisors and cuspidati; for they are the only teeth which are larger than their predecessors.

It most frequently happens to the cuspidati, because they are often formed later than the bicuspids; in consequence of which, the whole space is taken up before they make their appearance: in such cases they are obliged to shoot forward or outwards over the second incisor. However, it frequently happens to the incisors, but seldom to such a degree. This arises often from the temporary cuspidatus of one or both sides standing firm. I have seen the irregularities so much as to appear like a double row.

The bicuspidati generally have sufficient room to grow, because even more space, than what they can occupy, is kept for them by the temporary grinders. This, however, is not

Fig. 2.— Hunter's conception of occlusion.

Fig. 3.—Teeth in occlusion, showing roots exposed and lingual view.

universally the case; for I have seen where the bicuspidati were obliged to grow out of the circle, very probably from their being later in growing than common.

That it is from want of room in the jaw, and not from any effect that the first set produce upon them is evident; first, because in all cases of irregularity we find that there is really not room in the jaw to allow of placing all the teeth properly in the circle, or that some are necessarily on the outside of the circle, others within it, while others are turned with their edges obliquely as it were, warped; and secondly, because the bicuspids are not out of the circle, although they are as much influenced by the first set as any of the others.

As they are not influenced by the first set, it cannot be of any service to draw the first possessor; for that gives way in the same proportion as the other advances. As the succeeding tooth however is broader, it often interferes with a shedding tooth next to it, the fang of which not being influenced by the growth of its own succeeding tooth, it does not decay in proportion as the other advances, and therefore the drawing of the adjoining shedding tooth is often of service.

In cases of considerable irregularity for want of room, a principal object is to re-

move those which are most out of their place, and thereby procure room for the others which are to be brought into the circle.

To extract an irregular tooth would answer but little purpose, if no alteration could be made in the situation of the rest; but we find that the very principle upon which teeth are made to grow irregularly is capable, if properly directed, of bringing them even again. This principle is the power which many parts (especially bones) have of moving out of the way of mechanical pressure.

The irregularity of the teeth is at first owing to mechanical pressure; for one tooth getting the start of another, and fixing firmly in its place, becomes a resistance to the young, loose, forming tooth, and gives it an oblique direction. The same principle takes place in a completely formed tooth, whenever a pressure is made upon it. Probably a tooth might by slow degrees be moved to any part of the mouth, for I have seen the cuspidati pressed into the place of the incisors. However it is observed that the teeth are easier moved backwards than forwards, and when moved back that they are permanent, but often when moved forwards, that they are very apt to recede.

The best time for moving the teeth is in youth, while the jaws have an adapting disposition; for, after a certain time, they do not readily suit themselves to the irregularity of the teeth. This we see plainly to be the case, when we compare the loss of a tooth at the age of fifteen years, and at that of thirty or forty. In the first case we find, that the two neighboring teeth approach one another, in every part alike, till they close; but in the second, the distance in the jaw, between the two neighboring teeth, remains the same, while the bodies will in a small degree incline to one another from want of lateral support.

And this circumstance of the bodies of the teeth yielding to pressure upon their base, shows that, even in the adult, they might be brought nearer to one another by art properly applied.

Cause of pain in dentition.—These twenty teeth, in cutting the gum, give pain, and produce many other symptoms which often prove fatal to children in dentition. It has been generally supposed that these symptoms arise from the tooth's pressing upon the inside of the gum, and working its way mechanically; but the following observations seem to be nearer the truth.

The teeth, when they begin to press against the gum, irritate it, and commonly give pain. The gums are then affected with heat, swelling, redness, and the other symptoms of inflammation. The gum is not cut through by simple or mechanical pressure, but the irritation and consequent inflammation produces a thinning, or wasting of the gum at this part: for it often happens that when an extraneous, or a dead substance, is contained in the body, that it produces a destruction of the part between it, and that part of the skin which is nearest it, and seldom of the other parts, excepting those between it and the surface of a cavity opening externally, and that by no means so frequently.

As the operation of moving the teeth is by lateral pressure upon their bodies, these bodies must first have passed through the gum sufficiently for a hold to be taken.

The best time seems to be, when the two grinders of the child have been shed; for at this time a natural alteration is taking place in that part of the jaw.

The means of making this pressure I shall only slightly describe, as they will greatly vary according to circumstances, so considerably indeed, that scarcely two cases are to be treated alike, and in general the dentists are tolerably well acquainted with the methods.

In general it is done with ligatures of plates of silver. The ligatures answer best when it is only required to bring two teeth closer together, which are pretty much in the circle. The trouble attending this is but trifling, as it is only that of having them tied once a week or fortnight.

Where teeth, growing out of the circle, are to be brought into it, curved silver plates, of a proper construction, must be used. These are generally made to act on three points, two fixed points on the standing teeth, and the third on the tooth which is to be moved. That part of the plate, which rests on the two standing teeth, must be of a sufficient length for that purpose, while the curved part is short, and goes on the opposite side of the tooth to be moved. Its effect depends very much on the attention of the patient, who must frequently press hard upon it with the teeth of the opposite jaw; so that this method is much more troublesome to the patient than the ligature.

It is impossible to give absolute directions what tooth or teeth ought to be pulled out. That must be left to the judgment of the operator; but the following general hints may be of service:

1. If there is any one tooth very much out of the row, and all the others regular, that tooth may be removed, and the two neighboring ones brought closer together.

2. If there are two or more teeth of the same side very irregular (as for instance, the second incisor and cuspidatus) and it appears to be of no consequence, with respect to regularity, which of them is removed, I should recommend the extraction of the farthest back of the two, viz., the cuspidatus; because, if there should be any space, not filled up, when the other is brought into the row, it will not be so readily seen.

3. If the above mentioned two teeth are not in the circle, but still not far out of it, and yet there is not room for both; in such a case I would recommend the extraction of the first bicuspidati, although it should be perfectly in the row, because the two others will then be easily brought into the circle; and, if there is any space left, it will be so far back as not to be at all observable.

The upper jaw is often rather too narrow from side to side, near the anterior part which supports the fore-teeth, and projects forwards considerably over the lower, giving the appearance of the rabbit-mouth, although the teeth be quite regular in the circle of the jaw.

In such a case it is necessary to draw a bicuspidati of each side, by which means the forepart of the circle will fall back; and if a cross bar was to be stretched from side to side across the roof of the mouth, between cuspid and cuspid, it would widen the circle. These fore teeth might also be tied to this bar, which would be a means of assisting nature in bringing them back. This has been practiced, but it is troublesome.

As neither the bodies nor the fangs of teeth are perfectly round, we find that this circumstance often becomes a cause of their taking a twist; for, while growing, they may press with one edge only on the completely formed tooth; by which means they will be turned a little upon their center.

The alteration of these is more difficult than of the former, for it is, in general, impossible to apply, so long and constantly as is necessary for such an operation, any pressure that has the power of turning the tooth upon its center. However, in the incisors, it may be done by the same powers which produce the lateral motion; but where these cannot be applied, as is frequently the case, the tooth may be either pulled out entirely, and put in again even, or it may be twisted round sufficiently to bring it into a proper position, as has been often practiced.

CHAPTER VII

Irregularities between the teeth and jaw.—Certain disproportions between the teeth and jaw sometimes occur, one of which is when the body of the lower jaw is not of sufficient length for all the teeth. In such cases, the last grinder never gets perfectly from under the coronoide process, its anterior edge only being uncovered; and the gum which still in part lies upon the tooth, is rubbed against the sharp points of the tooth, and is often squeezed between the tooth upon which it lies, and the corresponding one of the upper jaw. This occasions so much uneasiness to the patient, that it becomes necessary to relieve the gum, if possible, by dividing it freely in several places that it may shrink and leave this surface of the tooth wholly uncovered. If this does not answer, which is sometimes the case, it is advisable to draw the tooth.

Sometimes, although but seldom, an inconvenience arises from the dentes sapientiæ being in the upper jaw, and not in the lower; these teeth pressing upon the anterior part of the root of the coronoide process, when the mouth is shut; for the coronoide processes are farther forwards in such cases, than when the lower jaw also has its dentes sapientiæ; in short, the exact correspondence between the two jaws is not kept up. In such cases I know of no other remedy, but the extraction of the tooth.

Supernumerary teeth.—When there are supernumerary teeth, it will, in general, be proper to have them drawn; for they are commonly either troublesome, or disfigure the mouth.

CHAPTER VIII

Of the under jaw.—It is not uncommon to find the lower jaw projecting too far forwards, so that its fore-teeth pass before those of the upper jaw, when the mouth is shut; which is attended with inconvenience, and disfigures the face.

This deformity can be greatly mended in young people. The teeth in the lower jaw can be gradually pushed back in those, whose teeth are not close, while those in the upper can be gently brought forward; which is by much the easier operation.

These two effects are produced by the same mechanical powers. While this position of the jaw is only in a small degree, so that the edges of the teeth can be by the patient brought behind those of the upper, it is in his own power to increase this, till the whole be complete; that is, till the grinders meet; and it is not necessary to go farther. This is done by frequently bringing the lower jaw as far back as he can, and then squeezing the teeth as close together as possible.

But when it is not in the person's power to bring the lower jaw so far back, as to allow the edges of its fore teeth to come behind those of the upper, artificial means are necessary.

The best of these means is an instrument of silver, with a socket or groove shaped to the fore-teeth of the lower jaw to receive them, so as to become fast to them (Fig. 4) and sloped off as it rises to its upper edge, so as to rise behind the fore-teeth in the upper jaw in such a manner, that, upon shutting the mouth, the teeth of the upper jaw may catch the anterior part of the standing surface, and be pushed forward with the power of the inclined plane. The patient, who wears such an instrument, must frequently shut his mouth with this view.

These need not be continued longer than till the edges of the lower teeth can be got behind those of the upper; for it is then within the power of the patient, as in the first stated case.

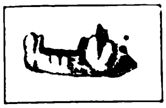


Fig. 4.—Appliance of Hunter to correct irregularities of the teeth.

Auzebi (1771), a dentist in Lyons, published a treatise on odontology, which is only remarkable for certain strange ideas that he expresses therein, the entire book being in complete contradiction with the great progress already realized at that period, in dental science.

To facilitate dentition he recommends among other things rubbing the gums with rough, hard and angular bodies. He also maintains, as does Brunner, that the milk teeth have no roots, contradicting in this respect, the opinion of Fauchard, Bunon and Bourdet, who decidedly affirm that the deciduous teeth are furnished with roots, precisely the same as the permanent ones. According to Auzebi, when it so happens that the milk teeth have roots, they are not shed.

Robert Wooffendale, the first to practice dentistry in America, in his *"Observations of Human Teeth,"* published in 1783, devoted some little time to the correction of irregularities. Being a pupil of Thomas Berdmore, he continued along the lines of his preceptor. In October, 1766, Mr. John Wooffendale arrived in the United States from England. This gentleman was the first regularly educated dentist of whom any record can be found as having visited this country.

Mr. Wooffendale commenced practice in New York soon after he arrived, later practicing in Philadelphia. In March, 1768, either because he did not receive sufficient practical encouragement in his profession, or from some other and unexplained cause, he returned to England.

The first recorded set of teeth inserted in America (an entire double set of artificial teeth) for Mr. William Walton, of New York, was constructed while he was there. From the time when Mr. Wooffendale returned to England until some years after the Declaration of Independence there was not, as far as can be discovered, a regularly practicing dentist in this country.

It is interesting to note just what the condition and the knowledge of malocclusion was at that time.

"If proper attention was paid to the removal of the first set of teeth, the just symmetry and proportion of the second might be preserved, and consequently every inconvenience and defect arising from irregularity of the teeth would be avoided. . . . When the teeth come irregular and have been neglected for some time, they frequently may be reduced into proper order with safety. This operation often takes some months if the teeth are much out of their places, the younger the patient the better when this operation is to be performed. There is a method of performing it very expeditiously, by twisting the teeth into their places by means of a pair of strong plyers. This method is practiced by some; but it may not be improper to observe that the patient is liable to have the bony socket split, or the teeth broken or forced out in the operation, yet allowing none of these accidents to happen, they often remain loose and troublesome ever after."

When the coming of the canines is much delayed, and there is a prospect of their irregular presentation, he says: "It is sometimes (though not always) advisable to take out either the first double, or the second single teeth, to give room for the progress of the eye teeth."

Observations of the teeth from six to twelve years old.—Of taking out the shedding, or first teeth.

The advantage of taking out the first teeth, at proper times, will be very considerable, as it will prevent the second set coming crooked, which they are subject to do; some projecting forwards; some inclining inwards; others riding one over the other, altogether, or in part; some twisted half round, presenting the side edge where the front ought to be, which gives a very awkward appearance; but which are not the only inconveniences; for, by coming in the above mentioned crooked direction, they cannot be kept clean, consequently are more liable to decay; and, for want of that regularity in the teeth, so pleasing to the sight, the mouth is frequently crooked, and the shape of the face much altered. By introducing the finger under the lip of a person whose teeth grow in an irregular order, it may be observed that the irregularity continues nearly to the extremity of the root of such teeth. This observation proves, that the bony socket is altered by irregular teeth, and we find in skeletons, that the shape of the bony socket is uneven, when the teeth are irregular.

Persons whose teeth grow in this disagreeable manner are desirous of hiding the deformity from view as much as possible with the lips, by which means they generally acquire an ungraceful habit of drawing the mouth on one side; and sometimes of endeavoring to draw the upper and the under lip, so as to conceal as much as possible all the teeth in the mouth; which has a formal and unpleasant effect, and prevents that freedom and ease in the conversation which they would enjoy if freed from such restraint. Even, regular teeth, are one of the greatest ornaments of "the human face divine"—give an elegance and expression to the countenance—and contribute, in an essential manner, to the beauty and regularity of the face; as, without such aid, the harmony of the most perfect set of features would be incomplete.

This is an operation I never performed in this mode; and at present I am of the opinion I never shall; it bespeaks a want of humanity, honor, or professional knowledge in the dentist who performs it in such a manner; as methods much more safe, easy, and efficacious may be practiced.

With all the circumspection and art a dentist can use in the removal of the first set of teeth, he cannot (as far as my observations have informed me) at all times be certain that the eye-teeth will come in their proper places, when they do not appear sooner than the age of fourteen, sixteen or eighteen years.

Of being under-jawed.—This is a circumstance often seen and which produces a disagreeable effect when it takes place; it is occasioned by the front teeth of the under jaw projecting before the front teeth of the upper jaw. There are very few cases of this kind (I believe not one in a hundred) that might not be remedied or prevented by the dentist,

allowing he has the teeth from six to fourteen years of age. When circumstances of this nature are neglected in early life, the under jaw becomes considerably lengthened during its growth; and the front teeth in both jaws are generally rendered useless in mastication.

I have not found the under jaw to project before the upper one in children, while they had their first teeth only.

When persons are under-jawed, and intend having them reduced, they should first reconcile themselves to submit to such a process as will be necessary to perfect the cure; which is often attended with little pain, and the operation is completed in a week or fortnight; although it will sometimes require some months to perfect it.

When this operation is to be performed, the younger the patient is the better.

It is impossible to give directions for reducing the under jaw when it projects before the upper one, as it is rare to see two cases circumstanced exactly alike.

I have seen some persons whose under jaws have been too broad for the upper ones (but not too long); those parts of the large double teeth in the under jaw which should be opposed to the grinding surface of those in the upper jaw coming in contact, in mastication (or when the teeth in each jaw touch) with that side of the large double teeth in the under jaw that should lay against the cheek; causing the double teeth in the upper jaw to occupy too small a space for those of the under jaw.

There are some persons whose upper and under front teeth never touch each other; therefore are of no use in mastication. The inconvenience may sometimes be remedied; but, as in the two immediately preceding cases, the method of procedure will be so variable, according to circumstances, that it is not in my power to lay any given rule to proceed by.

I have met with some few instances of the teeth in the front of the upper jaw occupying too large a space for the teeth in the front of the under jaw. This inconvenience may generally be relieved, by reducing the number of teeth in the upper jaw; and, sometimes, without extracting any teeth.

The reasons for the use of the file given by Wooffendale are as follows: "The teeth are filed on various accounts, viz., to remove broken or jagged points which happen either from accident or decay and are liable to injure the tongue; to stop the progress of a beginning or advancing caries; to round off edges of the teeth, though not decayed or broken, that grow irregular and prove troublesome to the cheek or tongue; lastly, for ornament." He adds, "Some universally condemn filing teeth; on the other hand, some are for having all teeth filed—I apprehend some teeth cannot be filed without being injured by it; others cannot be saved by any other method."

Crude as were the above ideas regarding the use of this instrument, they were universally held at the date of Wooffendale's writing. The removal of "broken or jagged points," and the rounding off of edges of the teeth that grow irregular and prove troublesome to the cheeks or tongue, are ideas descended direct from Celsus.

Robert Blake (1793) in his *Inaugural Dissertation* published in 1798, takes issue with Hunter in regard to the causes of irregularities of the teeth and the results saying: "In the fetus three or four months old, the rudiments of the teeth are placed nearly regular, but as they increase more rapidly than the arch, the jaws, we find some of them at birth, as it were, pressed out of the circle for want of room, particularly the cuspidati; so that the sockets of the lateral incisors and those of the anterior grinders nearly come in contact. However, the jaws gradually accommodate themselves to the teeth, and increase at this part nearly in proportion to the size of the cuspidati, becoming again regular, for, indeed, we seldom or ever meet the temporary teeth irregular. This Mr. Hunter allows, but says (*Natural History of the Teeth*), 'The jaw still increases in all

points till twelve months after birth, when the bodies of the six teeth are pretty well formed; but it never after increases in length between the symphysis and the sixth tooth; and from this time, too, the alveolar process, which makes the anterior part of the arches of both jaws, never becomes a section of a larger circle; and after this time the jaws lengthen only at their posterior ends.' Mr. Hunter supposed, as the temporary grinders are larger than the bicuspids which succeed them, that the difference in size of these would be sufficient to allow the permanent incisors and cuspidati, which are much larger than their predecessors, to become regular, without any increase of the arch or circle. He was led into this opinion by comparing four lower jaws of different subjects, and at different periods of life, from the age when the five temporary teeth are completed, to that of an entire permanent set. He acknowledges, however, that it is impossible there should be a mathematical exactness in four different jaws, nor, indeed, is there a mathematical exactness in the lines drawn to support his theory, for they are by no means parallel.

"Indeed, so varied are the dimensions of the jaws, that the arch of one year old may correspond or even exceed the arch of the adult and *vice versa*, the arch of an adult may be nearly as large again as that of the child, so it is not by comparing different jaws together that we shall be enabled to draw proper conclusions; but by comparing the permanent and temporary teeth of the same jaw.

"It appears from my preparations, and experience convinces men, that the space occupied by the temporary teeth would not be sufficient to accommodate the same number of permanent teeth which succeed them, and which, on the whole, are so much larger, particularly in the upper jaw. This fact, Mr. Hunter was aware of, and mentions that irregularities are more frequently met with in the upper than in the under jaw; so far I agree with him.

"We have seen the rudiments of the permanent teeth at first placed nearly regular, but as ossification advances on them, they become crowded together for want of room. This irregularity particularly happens to the permanent teeth. because they are the first situated at the internal part of the jaw, and, of course, in a much smaller circle than the temporary. In the under jaw, the lateral permanent incisors hide nearly half of the middle ones, and the lateral incisors and anterior bicuspids are so close together, that the cuspidati would not have room enough to pass up between them. In the upper jaw there is a much more confused appearance, and a more striking contrast with respect to the difference in size of both sets of teeth, the lateral incisors rest in part on the middle ones, and the sockets of the lateral incisors and the anterior bicuspids nearly come in contact; so that the cuspidati are entirely thrown out of the circle. We have seen also that the pulps and membranes of the permanent teeth were first very small and that the sockets were in proportion; but as the pulps enlarged and ossification advanced on them, the sockets increased likewise. It is but just, therefore, to suppose that the teeth rise and appear through the gum, and alveolar processes should accommodate themselves to them; which, indeed, will presently appear to be the case. If Mr. Hunter was a practitioner in this branch, even with very little experience he must have frequently observed in children of about six or seven years old (if the first teeth had not already fallen), large distances

between the incisors, which at first were quite close to one another. I have seen hundreds of instances in which the four permanent incisors appear irregular but in a short space of time became perfectly regular without any artificial assistance. In a preparation of Dr. Munro's (which he was kind enough to allow me to take a sketch of) the four permanent incisors of the under jaw had appeared, and also the middle incisors of the upper, and were perfectly regular, though the temporary cuspidati and grinders had remained, in the former, and the lateral incisors, cuspidati and grinders in the latter. Surely, then, these teeth could have gained no room from the difference in size of the grinders and bicuspids; it must, therefore, be owing to an increase in the arches of the jaws in these parts exactly in proportion to the difference in size of the temporary and permanent incisors. There is still in this case further necessity for considerable increase of the arches, on account of the irregular situation of the permanent teeth as well as because several of them had not as yet arrived at their full size."

"From what is now said I feel myself justifiable in concluding that the alveolar arches continue to increase during the entire progress of the formation of the teeth; it is, however, sufficiently evident that the greatest increase of the jaws is backwards. I do not by any means deny but that we frequently meet with disproportions between the jaws and teeth, and in such that the permanent teeth never would become regular without the assistance of art, even in young persons; this may arise from the resistance of the temporary teeth, or from teeth forming so much out of the circle that they have not sufficient power to act on their neighbors and press them back, such as the cuspidati, which are most commonly irregular. Indeed, if Mr. Hunter's hypothesis were true, we would never see a regular set of teeth."

Undergraduate Assistants for the Forsyth Dental Infirmary for Children

DURING the months of June, July, August and September, an opportunity is offered by the Trustees of the Forsyth Dental Infirmary for Children to a limited number of undergraduate students to act as assistants in the clinics of the Infirmary. This privilege permits a student to obtain unusual clinical advantages in the various departments of the institution where Operative Dentistry, Orthodontia, Nose and Throat, Oral Surgery, Radiography, Pathological Diagnosis and Research Work are continually carried on. Operators' gowns and all instruments are furnished. Over three hundred children are treated daily. For further details apply before May 15th to the Director, Dr. Harold DeW. Cross, 140 The Fenway, Boston.

THE IDEAL AGE FOR THE CORRECTION OF MALOCCLUSION*

By W. W. Martin, D.D.S., Kansas City, Mo.

THE question is usually asked by the general practitioner, and also arises in the mind of the specialist, as to what is the exact age, or the ideal age, for the treatment of malocclusion. The advice that was generally given several years ago by the majority of men in the dental profession who were consulted in regard to the treatment of malocclusion was to allow the case to wait awhile, as the irregularity might correct itself. Experience has proven that waiting is of no avail so far as correcting the malocclusion of the permanent teeth is concerned, and, in fact, there is no evidence to substantiate the claim that malocclusion of the deciduous teeth ever improves as the result of the patient waiting. It must, however, be evident to those who have observed a number of cases of malocclusion, either in their own practice or in the practice of others, that there must be an ideal time at which certain types of malocclusion can be advantageously treated; that there must be a period in the development of malocclusion at which desired results can be obtained in the shortest possible time, and when the least trouble will be experienced in the process of retention. It is a well known fact, as stated by Lischer, that malocclusions are of slow development. The majority of them have a small beginning, and become more complicated as the individual becomes older and a larger number of teeth erupt. As a result of this condition, there has been developed during the last few years a new feature by some orthodontists, namely, preventive orthodontics, or preventive treatment. There is no question that preventive medical treatment has been of great benefit to the human race. There is also no question that prophylaxis in dentistry has played an important part in this amelioration, and any treatment that prevents complications of malocclusion is to be commended.

With these facts in mind, let us consider what may be accepted as the ideal age for receiving certain types of malocclusion. It has been established that certain malocclusions make their appearance in the deciduous teeth, and that marked benefits will be derived by treating those malocclusions. I refer particularly to distoclusion, Class II, and mesioclusion, Class III. It is our belief that disto- and mesioclusion, when present in the deciduous teeth, should be treated at as early an age as possible. The treatment of these mesio- and distoclusions in the deciduous arches will establish normal relation of the cusps, cause the proper action of the cusps during mastication, and produce the proper function of the muscles, and therefore create as nearly as possible a normal development of the mandible and the maxilla. If a case of distoclusion in the deciduous teeth is allowed to go uncorrected, there will follow a distoclusion in the permanent teeth, and such results will also occur in mesioclusion. If, however, we correct the case of distoclusion in the deciduous arches, it is very probable, if nothing untoward arises, that the permanent teeth will occupy their proper posi-

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tions. It is also probable that, unless the patient becomes a mouth breather, or an etiological factor arises to again produce a distoclusion, the permanent teeth will occupy their normal mesiodistal relation. If we correct the case of distoclusion of the deciduous arches, and some etiological factor arises later in life to produce the same condition again, we could not expect the treatment of the deciduous arch to prevent the same etiological factor causing a malocclusion of the permanent arches. That is likewise true in the case of mesioclusion. We might correct the mesioclusion and get the teeth in proper relation, and later in life the patient might develop extremely large faucial tonsils about the time of the eruption of the first molars; he might develop a rachitic condition, resulting in a softening of the mandible. The result would be etiological factors causing mesioclusion again, which would, in all likelihood, develop in the permanent teeth. These matters are mentioned as a caution against making a promise that the correction of malocclusion of the deciduous teeth will always be a preventive of malocclusion in the permanent teeth.

There have been cases where treatment of distoclusion in the deciduous arches has corrected the distoclusion, but neutroclusion developed in the permanent arches. As a result of such occurrence and of other conditions that have arisen, it has become a practice with some orthodontists to treat the deciduous arches for neutroclusion, or in other ways expand the deciduous arches to prevent malocclusion of the permanent teeth. It is a theory of some men, and unfortunately held by some men of international reputation, that, by the expansion of the deciduous arch, neutroclusion of the permanent teeth will be prevented even if there are no neutroclusions of the deciduous arches. In other words, this theory is equivalent to saying that the permanent arches will always be crowded or contracted, and that every child is doomed to have a malocclusion of the type of neutroclusion. This theory is that, as the permanent teeth are larger than the deciduous teeth, there is not sufficient room in the deciduous arch, and consequently, in the expansion of the deciduous dentures by moving the deciduous teeth labially and buccally, sufficient room will be created for the permanent teeth because this movement of the deciduous teeth stimulates and creates a growth. It is a well-known fact that, before the permanent teeth erupt and before the deciduous teeth are lost, if the child is developing normally, there will be spaces formed between the deciduous teeth. These spaces in a child who erupts a central incisor at the age of 6 begin to make their appearance at about the age of 5 years, or a little later. It is the practice of some men, when they see a deciduous arch is not spacing, to put on an appliance and expand those deciduous arches, even though the deciduous teeth are in perfect normal position. Now, all children do not develop with the same rapidity; spaces may not exist at 5, but would exist at 5½ years; a condition that would be perfectly normal in one child at 5 would not be normal for another at the same age. In other words, children do not develop with the same degree of rapidity according to the calendar. A child may be 6 years old according to the calendar, but, so far as dental development is concerned, it may be only 5. For these reasons, the ideal age of the child for the treatment, must be determined by the condition of the dental apparatus. It is our belief that a great many deciduous arches are expanded when a child is treated according to its age that should not have re-

ceived such treatment, and many children are consequently forced to wear regulating appliances at a time when they are not necessary. In such cases, the patient is being subjected to a line of treatment that almost borders on charlatanism.

There are, however, some types of neutroclusion in the deciduous teeth that should receive attention, and such types are labial and lingual relation of the upper or lower incisors. For instance, if we find an upper incisor or all of the upper incisors of the deciduous arch biting lingual to the lower incisors, the condition should be treated; and if we find a decided case of bunching or torsoclusion of the deciduous teeth, that condition should also be treated. I have never observed in my practice a case of extreme torsoclusion of the deciduous dentures, nor have I ever seen a model that shows such a condition. Occasionally we will find the lower central incisors slightly rotated, but they are rotated to such a small extent that treatment will not be advisable because, even though they are rotated, there is sufficient space in the arch to accommodate them in their normal condition. To correct the rotation would not increase the development of the dental arch, and, of course, it is not to be expected that correcting the rotation of a deciduous tooth will have any influence on the permanent tooth, as in the absorption of the root of the deciduous tooth the alveolar process is also absorbed with it, and therefore the correction of the rotation cannot possibly have any influence on the production or prevention of torsoclusion of the permanent tooth.

It is our opinion that the earliest age at which the treatment of neutroclusion of the deciduous teeth should be attempted with the idea of preventing further complications is at the time of the eruption of the permanent tooth. If the permanent central incisor is about to erupt, and there is not sufficient room between the deciduous laterals or the two incisors, so that the permanent centrals are in torsoclusion, or are erupting labially or lingually, then, and not until then, should the expansion of the deciduous arches be recommended. If the permanent central incisors are not prevented from getting into their proper positions, and even though there is no development between the deciduous canines and the centrals to accommodate the permanent laterals, it is better to wait until the permanent lateral begins to erupt; and if we see that it is taking a malposition, we can then begin to expand, for we will have ample time to expand the arch and tease the lateral incisor into its proper position before it erupts occlusally in the plane of occlusion. That will be sufficiently early for treatment, for it is a histological and anatomical fact that, even after the crown or cutting edge of the tooth has reached the plane of occlusion, the root of the tooth has not completely formed. If we succeed in getting a tooth in its proper position before the formation of the root, we will have gained all we need so far as physiological development of the tissue around the tooth and the root of the tooth is concerned.

In the treatment of the mesio- and distoclusion it must be remembered that the mesial and distal positions of the individual first molars are influenced by the proximal contact of the deciduous teeth. Very often we will have a loss of a deciduous molar, which will allow one of the permanent molars to drift forward mesially, and, of course, that drifting of the molar should be treated

at once, both with the idea of establishing a normal mesiodistal relation of the molars and making the proper space for the erupting premolars. If the deciduous teeth are in their positions, it must be borne in mind that, as the second premolar is wider mesiodistally than the upper deciduous molar, the lower first permanent molars will necessarily be held distal until the deciduous molars are lost. This must be remembered so as not to consider these conditions as one of distoclusion, because, if the deciduous teeth are lost in their proper order, the lower molar will seek its proper relation to the upper during the shedding of the deciduous teeth. We have seen several cases that were diagnosed and treated as distoclusion which were not distoclusion, but were normal conditions existing at that age of the individual. Of course, mesio- and distoclusion of the permanent teeth should be treated as soon as possible, for nothing is gained by waiting, as the complications will become worse. It was formerly argued that, owing to the nervous strain placed on the patient, the treatment of malocclusion should be delayed until the patient was older. That is entirely wrong, for, if the malocclusion is treated properly, there is not as much nervous strain placed upon the patient from wearing the appliance as there is on the general system as the result of malocclusion, which prohibits proper mastication and respiration.

We have considered only the ideal age for the treatment of malocclusion, but that condition can be treated much later in life than the age which we have mentioned. While malocclusion can be treated at 15 and 16 years of age and even later, it is not the ideal age at which to treat them, and advice should not be given which would allow patients to conclude that they can be treated as well at that age, for they cannot. Even though results can be obtained at the later age, they are acquired with much more difficulty.

CHANGING FROM GENERAL PRACTICE TO ORTHODONTIA —A FEW EFFORTS*

By H. B. Hamilton, D.D.S., Ithaca, N. Y.

THE orthodontist maintains that general dentistry and orthodontia cannot be practiced together without one or the other, or both, being slighted to a greater or a less degree.

There came a time in my practice when it became necessary to decide whether to continue attempting some of the cases presented among my patients, or to endeavor to become more proficient, and to give orthodontia a larger place in my work.

After spending the allotted time in the course of instruction, I returned home enthusiastic, and anxious to put my newly acquired knowledge to use, as well as to formulate plans to become an orthodontist in fact. But it is not easy to start a profitable orthodontic practice over night. Neither is it easy to cast off old patients in a general practice that has been years in the building. It was necessary to combine the two, giving the preference to the former, and

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making my living from the latter. This necessitated a new plan of conducting my practice. The appointment book, filled for weeks ahead, was no longer possible. Time must be available for orthodontia cases whenever they presented.

The first effort to limit my practice was the decision to take no new patients for any work outside of orthodontia.

The next rule was to make no appointments for general practice after 3:30 P. M., and on Saturdays. All of the remainder of the time was available for general work. Cases were few in the beginning, and much of this time was given to general dentistry.

It was also my endeavor to keep appointments from stringing out too far ahead. Patients asking for appointments were listed, together with the work required, and the most convenient times for the patient. The telephone was used, and appointments made only a short time in advance whenever the opportunity presented. This has worked out far more satisfactorily than anticipated.

These rules have not been easy to carry out. It is difficult to refuse new patients referred to us by old, but it is still harder to refuse members of the families already patients, and especially as in the case of a child just arriving at an age requiring work.

Another rule is to decline appointments to patients not seen in a long time. Patients will occasionally go several years without work and it is difficult to deny them, and particularly so when they have never been to another. But it is necessary to be firm.

All of these rules help to reduce the number of patients for general work, although not so rapidly as might be expected. In fact, at first it seems to stimulate business, for the mere announcement that you are specializing and limiting your practice brings in the old patients, who fear you will drop them, and the new ones who suddenly discover that you are the most desirable practitioner in town. Nevertheless, all of these things do cut down the general practice eventually provided they are rigidly carried out. Occasionally it is necessary to make exceptions, but as orthodontia cases increase, the exceptions are rare.

Nothing was said about the difficult patients, or those who are poor, or slow to pay. These we are always willing to eliminate, and now is the available time.

Another class that is easy to eliminate, are those always demanding immediate attention. If they are unwilling to wait until they can be cared for, but go elsewhere for the present work, they are no longer considered patients. This does not apply to those cases actually requiring attention at once.

All this time patients have been gradually impressed with the idea that orthodontia is my chief work, and takes precedence over everything else. They are being made to understand that probably some time in the future someone else must do their work, but at the same time informed that as long as I can care for them properly I shall be glad to do so.

The problem is not entirely solved, but these methods are helping. What the future demands, the future must supply.

AN APPLIANCE FOR OPENING UP SPACE FOR UNERUPTED BICUSPIDS

By Walter H. Ellis, D.D.S., Buffalo, N. Y.

THIS appliance, as illustrated, is a simple and effective device for opening up the space for unerupted or missing bicuspids, and occasionally for opening the space for a missing first molar, if the second molar is in place. It can be adjusted so that it will at the same time develop the entire arch.

It is, as far as I know, original, but I make no claims in that direction, because it is, as in many apparently new appliances or methods, but a new application or modification of older basic principles.

Its construction and application are well shown in the illustration. The molar bands, tubes, and threaded end sections are those usually used in other

forms of appliances. The lingual wire is .030 gold and platinum wire, bent to fit accurately the incisors, cuspids and bicuspids at the gingival line and the ends soldered to the threaded section.

This appliance can also be used in cases where the tooth is missing on one side only, by the following modification. It is made as in the illustration on the side where the tooth is missing, while on the other side the lingual wire is carried directly back to the mesiolingual surface of the molar where it is bent at right angles in such a way as to fit into a vertical tube, which is soldered to the molar band. It is best to use a lock spur as well, to prevent the slipping of the appliance. This vertical tube allows the lingual wire to turn sufficiently for the readjustment of the dental arch in its accommodation for the new space.

By turning the nuts gradually, the appliance will open the space with but very little attention or readjustment. It will also, with but slight simplification, act as a retainer. This appliance may be useful to the reader only to carry the case through an early period of treatment, this to be followed by an appliance for the bodily movement of teeth.

CURRENT ORTHODONTIC LITERATURE

EDITED BY H. C. POLLOCK, D.D.S.

A Further Study of Some Etiological Factors of Malocclusion

THERE has just come to our notice a very interesting paper (*Dental Cosmos,* February, 1916) on etiological factors of malocclusions read by Dr. Milo Hellman, of New York City, before the Eastern Association of Graduates of the Angle School of Orthodontia at its recent meeting in New York City. In order that the readers of this Journal may have a permanent record of this valuable contribution to orthodontic literature for their files, we have deemed it advisable to give this article in full. (Several illustrations that appeared in the original paper have been omitted.)

Despite the remarkable progress recently made in the mechanics employed in orthodontic therapeutics, the advancement of the knowledge pertaining to the causes of the disturbances thus treated is being rather neglected. So much time and thought is now being devoted to the perfection of the technical detail involved in the construction of the modern orthodontic appliances, that little seems to be available for a more thorough consideration of the underlying causes that find expression in the deformities known as malocclusion of the teeth.

It is rather paradoxical to think that the best minds in this specialty should seek the solution of a problem of such vast proportions by devising and multiplying the means for the treatment of various conditions without eliciting more strenuous efforts in the search for more exact knowledge of the causes that bring them about.

Medicine never reached a higher plane in the course of its development than in the recognition of the importance of prophylaxis. Prophylaxis, again, would never have been duly appreciated without a keen perception of the causes which bring about disease processes. It is, therefore, a self-evident truth that, if orthodontia is to gain a firm foothold within the domain of the art and science of healing, and be closely interwoven in the fabric of its allied branches, an earnest effort must be made for a more thorough investigation of the problems involved in the etiology of those deformities the correction of which are at present but empirically accomplished.

Statistics on Breast-Feeding Versus Bottle-Feeding in Their Influences Upon the Development of Teeth.—In the report published in the *Dental Cosmos,* September, 1914, p. 1017, the essayist outlined a method of procedure by which each and every individual interested in the progress of orthodontia should constitute a factor in its advancement. With this purpose in view, one thousand and fifty diagnostic charts were sent to the various specialists in orthodontia, with a reprint of the report, in order to obtain more data. So far only *five* charts have been received, properly filled out. This is the extent to which interest was shown and support given in the study of the problem on hand. Discouraged but little by the lack of interest thus far shown, the essayist proceeded to gather

his data, as heretofore, to study the material on hand, and to prepare a further report to this society. In order, however, to bring the new evidence into logical sequence with what has already been said, it will be necessary to reiterate some of the essential points dwelt upon a year ago.

(1) According to reliable statistics it was found in Berlin that the mortality of infants fed on cow's milk during the first year is six times greater than that of breast-fed infants. Furthermore, according to Dr. Thomas F. Harrington, from 80 to 90 per cent of all deaths from gastro-intestinal diseases among infants takes place in the artificially fed.

(2) Based upon an investigation of 2,400 cases, G. von Bunge found that 64 per cent of the women examined were decidedly unable to nurse their infants, and that this inability is on the increase.

(3) Upon the investigation of all chronic diseases that stand in close connection with the inability to nurse, Von Bunge discovered also that caries of the teeth is intimately related to it.

(4) Upon the investigation of the relationship between artificially fed infants and malocclusal conditions, it was found upon the examination of 84 cases of malocclusion that 81 per cent were partly or entirely bottle-fed.

The examination of 50 additional cases of malocclusion gave the following results: Breast-fed 6=12 per cent. Bottle-fed 12=24 per cent. Breast and bottle-fed 32=64 per cent.

This again shows that, while 12 per cent depended entirely on breast-feeding, 88 per cent had to resort to the bottle for sustenance. If this number be added to that of a year ago, the sum obtained would be 134, and would be classified as follows: Breast-fed 22=16 per cent. Bottle-fed 33=25 per cent. Breast-and-bottle-fed 79=59 per cent.

Combining those cases that had to resort to bottle feeding, we have 102=83 per cent, as compared with 81 per cent previously reported. It is evident, then, that with the increase in number of 50 additionally recorded cases, the percentage rises by two, although the reverse might be expected. The question arising now is: If it be granted that artificial feeding stands in close relationship with subsequent malocclusion of the teeth, what brings it about? Is it the presence of the bottle and the cow's milk that produces the pernicious effect? Or is it the absence of the breast and the normal mother's milk that creates conditions unfavorable for the perfection of the normal?

It has been maintained that "Although a disease or disturbance of any form represents the sum-total of a symptom complex, it may appear in any of its intermediate stages during the course of its development. Its recognition, therefore, depends upon the extent of knowledge related to the sequence of its progress." And "In order to gain the knowledge pertaining thereto, it is necessary to acquire an absolute mastery of all the probable factors that enter into the composition of such a symptom complex."[1]

If it be remembered that, in the life-cycle of the infant, the period of nursing is pregnant with a multitude of conditions, upon the records of which the future history of the dental apparatus will depend, it is quite plain that any change, alteration, or modification in the nature of the food, may produce a corresponding deviation from the normal in the functional activity of the mouth,

in the development of the incompleted dental organs, as well as in the health and growth of the entire individual. The manner in which artificial food is administered may also add its quota in this process. Furthermore, any aberration in the quality or quantity of the natural mother's milk may similarly represent a constitutional disturbance in the parent, the effects of which, as will be seen, probably have some influence upon the developing teeth of the offspring.

It will, therefore, be of logical significance to discuss our topic from the following points: I. What other processes stand in close relationship to those of the development of the teeth? II. What is the effect of the disturbances necessitating bottle-feeding upon the deciduous dentition? III. What testimony besides malocclusion does the permanent dentition bear of nutritional disturbances prevalent during the nursing period?

I. What Other Processes Stand in Close Relationship to Those of the Development of the Teeth?—Considerable prominence has been recently given in medical literature to the term "internal secretion." No work of any scientific value is now complete without a detailed account of the ductless glands. But popular as this gland apparatus has become in the scientific world, it is in nowise commensurate with the possibilities it has created for the interpretation of phenomena that have hitherto been inexplicable. Diseases whose causes and events were a book with seven seals, against which the medical world stood powerless, have been clearly interpreted by the aid of the science of "internal secretion;" cures have been effected in many instances, and the progress of disease has at least been interfered with in others. Also dentistry has been greatly benefited by this science. The study of pathological phenomena in tooth and jaw development has been guided into an entirely new path.

It is not intended to describe to any extent the intricacy of this most wonderful apparatus of glands, this being far beyond the scope of the present work. It may, however, not be out of place to touch upon the effects produced by these glands and to recommend the works of Biedl,[2] Cushing[3] and Kranz[4] for general as well as special information upon the subject of internal secretion. What is of interest in the present investigation is to find a clue to the manner in which the teeth and jaws are affected in some of the disturbances of these glands.

In a recent work on "Internal Secretion in Relation to Jaw Formation and Tooth Development," by Dr. P. Kranz, the author gives an adequate account of numerous investigations, including his own, of the various ways in which the teeth and jaws are affected by disturbances occurring in the ductless glands. The evidence adduced was obtained by the experimentation and clinical observation of such known authorities as have won recognition throughout the civilized world.

Malocclusions and Cretinism.—Thus, as early as during the middle of the last century, no less an authority than Virchow[5] described the malposition of the upper jaw after a careful study of the cretin-skull collection in Würzburg. Scholz,[6] in 1906, after a thorough description in his work on the changes in the cretin head, specially mentions that "The mouth is large, being surrounded by thick and swollen lips, and is constantly held open. The fleshy, thick tongue . . . is held motionless on the floor of the mouth, or hangs out of the open oral cavity." In 12 per cent of the cases examined he found faulty tooth formation,

while the dental arches were rarely regular. "Often," says he, "the teeth are out of alinement," assuming various forms of malposition. Also supernumerary teeth and missing dental germs are of no rare occurrence. According to Bayon, it is found that in those cretins who possess a good denture, a double tooth-row in the lower anterior region may be observed. The incisors are small, interspaced, and show vertical or horizontal ripples in the enamel covering of the crowns. The canines are seldom characteristic, being small and resembling the incisors. The wide lower jaw is shifted forward.

In the 56 cretin cases examined by Scholz, this investigator found 7 with protruding upper alveolar process and teeth, and 3 with protrusion of the lower. Eugene Bircher[7] also reports on numerous and varied occlusal anomalies observed in cretins. He found that, besides malposition of the teeth, also irregularity in the shedding of the deciduous and eruption of the permanent series is prevalent.

Fig. 1.—Cretin skull, showing enamel deficits in the form of ripples. (After Kranz.)

Fig. 2.—Lower jaw of thirty-one-year-old cretin, showing presence of deciduous teeth with their permanent successors. (After Kranz.)

P. Kranz, after extensive investigations of typical cretins in various institutions in Europe found on an average very poor dental conditions. "There was manifested the abnormal in both dental and jaw relationship, such as malpositions of the teeth, defects in their development, abnormal structures, and almost in every case high frequency of caries and enormous deposition of tartar." He observed three decided cases of Class III, but more often there appear conditions of underdevelopment and malpositions of the teeth of all sorts, from the simplest to the most complex. The teeth of most of the cretins presented structural defects in the form of longitudinal or horizontal ripples, the so-called "rickety" teeth. Fig. 1 shows horizontal ripples on all the teeth. The fifty skulls examined by the same author in the Pathologic Anatomical Institute at Gratz

simply verified his clinical findings. Fig. 1 represents a skull from the collection at this institute. Another rare case of anomalous development and malposition of the teeth is portrayed in Fig. 2, representing the lower jaw of a cretin of thirty-one years, in which the persistence of a number of deciduous teeth may be seen *in situ,* in conjunction with the permanent successors.

Disturbances of the Thyroid Gland.—The causative factor of cretinism is well established, and is known to be a diseased condition of the thyroid gland; it is until now the only known cardinal feature of all cretinoid conditions. It is never absent, and occurs typically at all ages, be it in the form of thyroid degeneration, strumous deterioration, or complete absence; or the thyroid gland may first hypertrophy and then gradually disappear.

As the etiology of this disturbance is quite clear, it was a simple matter to verify these findings by experimental evidence. Kranz, thereupon, thyroidectomized several pigs and rabbits in order to study the conditions produced. The rabbits showed retarded development and some ripples in the enamel covering of several teeth. The pigs, though failing to show any abnormalities in the de-

Fig. 3.—Skull of thyroidectomized pig, showing ripples on the teeth. (After Kranz.)

A B

Fig. 4.—Showing effect of experimental thyroidectomy. *A*, Normal dog. *B*, Thyroidectomized dog. Both of same litter. (After Biedl.)

velopment of the dentition and in position of the teeth, showed considerable underdevelopment and marked ripples on the enamel of the teeth, closely resembling those of the cretinoid dentitions. Fig. 3 shows the head of a thyroidectomized pig, exhibiting the ripple effect on the molars.

Other experimental evidence may be gathered from Biedl, showing the difference in development of body and dentition between a normal and thyroidectomized dog of the same litter. (See Fig. 4.) Both these dogs are four months old; thyroidectomy was performed on the small specimen when three weeks old. Fig. 5 shows the difference in the heads and dentures of the dogs presented in Fig. 4.

Disturbances of the Parathyroid.—While the diseased condition of the thyroid gland gives rise to the general disturbance known as myxedema, the elimination of the parathyroid produces tetany. Both experimentation and clinical observation coincide with this. But besides tetany, the extirpation of the parathyroid in animals also produces loss of hair, shaggy furs, emaciation, cataract. and disturbances in the teeth, due to alterations in the calcific materials.

The investigations of Erdheim[8] on the influence of the parathyroid body

upon tetany brought to light the grave trophic modification in the rodent teeth of his parathyroidectomized rats. They showed defective calcification of the dentin, whereby the rodent teeth were so weakened that they eventually fractured. The changes in the enamel, again, consist in partial interruptions thereof, the appearance of enamel drops in the epithelium and formation of creases in the latter, with a typical enamel production at a distance from the tooth.

Disturbances of the Thymus.—The thymus gland has been variously studied, and while a unanimous conclusion as to its exact functional importance has not as yet been reached, it has been found to play an important role in the develop-

Fig. 5.—Skulls of dogs as in Fig. 4, showing difference in size of head, jaws, and teeth in thyroidectomized and in normal dog. (After Biedl.)

A

B

Fig. 6.—*A*, Skulls of thymectomized dogs, showing difference in size of jaws and teeth of larger (normal) and smaller (operated) animal. (After Biedl.) *B*, Radiographs of the lower jaws of animals as in *A*, showing effect of thymectomy on the jaws, teeth and dentition. (After Kranz.)

ment of the skeletal system. Thymectomy produces a specific thymectogenous bone condition. The skeletal system remains hypoplastic or dwarfed in its entire growth. The bones become atrophic, bendable or breakable, according to the stage of development. A similar cause may produce rhachitis or osteomalacia in the same animal. The cause seems to be the lack of insoluble calcium, which is decreased more than half in the bone system of thymectomized dogs. Fig. 6, A, represents the heads of two dogs of the same litter. According to Kranz,

they were born October 28, 1911. While the one was thymectomized on November 14, 1911, the other served as a control. The experimental dog died on April 9, 1912, and the control animal was killed April 18th of the same year. In the figure it will be noted how much larger the skull of the control animal is as compared with that of the operated dog. The teeth of the normal animal are also more massive. In the thymus dog there is an appreciable tardiness in the dentition. There are anteriorly all the deciduous incisors, while their successors are just approaching their eruption. In the control animal there are but two tiny remnants of the deciduous denture, while the permanent incisors are all present, they being larger and more powerfully developed than those in the thymus dog. In the thymectomized animal there may be seen the delicate deciduous canine, and the permanent successor can barely be observed in its course of eruption; while in the control animal it may be seen that alongside of the large deciduous canine the massive permanent tooth has already taken its position. Also in the premolar series may be observed that while the thymus dog still shows two deciduous teeth, the control animal has erupted the three per-

Fig. 7.—Showing difference in size of the control (larger) and experimental (smaller) dog. (After Ascoli.)

manent ones. The molars in the thymectomized dog are considerably smaller than in the control. These differences are more appreciable in the lower jaw. (See Fig. 6, B.) While the normal animal shows only one deciduous premolar with resorbing roots in conjunction with the permanent teeth, the thymus dog exhibits all the deciduous teeth with the exception of the recently erupted permanent incisors. This shows that the thymus has doubtless influenced the development of the teeth and jaws.

Disturbances of the Pituitary Body.—Disturbances in the pituitary body are also known to bring about certain modifications in the jaws and teeth, besides giving rise to certain general diseases. Thus, Fischer[9] maintains that acromegaly and splanchnomegaly are due to disease conditions of the anterior part of that body. Following the experimental removal of the hypophysis in the dog, such marked differences may be observed two months after the operation that it is impossible to believe that the control animal belongs to the same litter as the experimental one. (See Fig. 7.) The experimental dog becomes obese,

sluggish, and stupid as compared with the normal animal. The epiphysis in the experimental dog never reaches a stage of complete development. Referring to the sexual desires, it may be said that in the experimental animal they are reduced to a minimum. Gravidity never takes place, and, if existing, it is interrupted by the removal of the pituitary body.

In regard to the dentition we may follow the observations of Legnani and Ascoli,[10] as well as those of Aschner:[11] "While the change in dentitions in the normal animal is completed regularly from the fourth to the fifth month, there is a persistence of the deciduous dentition in the experimental dog up to the 12th or 13th month—according to Aschner even throughout life. Aschner observed in small operated animals by the end of the first year the persistence of the deciduous dentition and the eruption of certain permanent teeth (incisors and canines), so that a double tooth-row existed, all the deciduous teeth being perfectly firm."

Figs. 8, A and B, by Ascoli, illustrate the difference in size, in head formation, and in the dentitions of the two dogs. There may be observed that in the experimental animal there are, in addition to the deciduous teeth, also some

A

B

Fig. 8.—Skulls of dogs as in Fig. 7, showing difference in size of jaws, teeth, and dentition. (After Ascoli.)

permanent ones; the latter are more delicate than and differ in form from those in the normal dog of the same age (sixteen months). These differences are more clearly shown in the lower jaws of the dogs. In this connection it may be mentioned that an increase in functional activity of the pituitary body produces acromegaly, with symptoms similar to those described in the experimental dogs. The case of Pehr Gadd, reported a year ago,[12] may be recalled, where there was an extreme enlargement of the lower jaw-bone, due to a tumor in the hypophysis.

Disturbances in the Sexual Glands.—The sexual glands also have been declared by several investigators (Dupuytren, Meckel and Gruber) to produce certain changes in the bone formation of the entire skull, especially in the jaw-bones. Thus in castrates the lower jaw will develop to an enormous extent, as will also several of the other bones of the head.

The close relationship existing between the function of the ductless glands

and the formation of jaws and teeth may readily be appreciated. But while the manner in which it is effected has as yet not been definitely ascertained, it is quite plain that the development of the teeth and jaws is, to a very large extent, governed by the activity of this highly complex glandular system.

II. What is the Effect of the Disturbance Necessitating Bottle-Feeding Upon the Deciduous Dentition?—The effect upon the deciduous dentition of the disturbances necessitating bottle-feeding is mainly in the form of malpositions. This phase of the subject, having been amply discussed a year ago, will not be referred to now. Modifications in form and structure of the deciduous teeth date farther back than the nursing period, as almost all the crowns of the temporary teeth are formed and calcified before birth. It is therefore of considerable interest to observe occasionally deciduous dentitions with anomalies in form and and structure. Four such cases have come under my observation.

One case is that of an infant of three years, presenting a Class II, division 1, case of malocclusion. All the teeth present white opaque spots, the upper central incisors show slight fractures, and the lower incisors are diminutive in form. During pregnancy the mother suffered greatly from "heartburn," and to relieve it, she took a great deal of antacids. The teeth in this case are undoubtedly poorly calcified.

Another case, age seven years, Class I, shows extremely small lower central incisors, the crowns measuring 3 mm. in width and 2.5 mm. in length; the smallest deciduous central incisors in my collection measure 3.7 mm. in width. The lower lateral incisors are missing, while all the upper incisors show extreme wear. During the eruption of all the teeth, lancing had to be resorted to in order to facilitate the process. The mother, although an apparently robust woman, was ill throughout the period of gestation, and during parturition instruments had to be employed. She succeeded in nursing the infant for three months. during which time the baby thrived very poorly. Bottle-feeding was then resorted to for about two years. The deciduous teeth in this patient are all still firm, and the first permanent molars have as yet not appeared. The two other cases showed marked enamel hypoplasias in the lower deciduous molars and a tendency to extensive decay.

Following the experimental and clinical evidence brought forth in conjunction with the ductless glands, it may be concluded, as far as our present knowledge will permit, that all calcium metabolic processes in the living body are governed by the functional activity of the internal secretory system. Any deviation from the normal in the function of this system will produce a corresponding perversion in the processes depending upon it. Conversely, any defect in the structure of a part depending for its perfection upon calcium metabolic processes, may be referred to some disturbance in the internal secretory apparatus. It may, therefore, be seen that the defects observed in the deciduous teeth of the infant are due to some disturbance in its ductless glands. But as the mother's influence, owing to the normal functionating of this apparatus, corrects these shortcomings in the fetal stage through the placental circulation, and in infancy through lactation, it must be deduced that, in such cases, the internal secretory apparatus must have been defective also in the mother.

III. What Testimony Besides Malocclusion Does the Permanent Dentition

Bear of Nutritional Disturbances Prevalent During the Nursing Period?—In a paper by Wm. M. Thompson[13] it has been shown that the thyroid glands have a marked influence upon lactation. Hertogue[14] believes that thyroid given to lactating women increases the flow of milk, and Bang[15] states that the active principle of these glands is excreted by the milk. Almagha[16] in his experiments demonstrated that, by removing the thyroid apparatus from young puppies, no ill effects were produced while they were suckled, but when this was suddenly stopped the animals died. It may thus be seen in what intimate relationship lactation and internal secretion really stand. Furthermore, as the calcification process of the permanent teeth is not manifested until after birth, at a period coincident with that of lactation, it may be evident that disturbances occurring in the internal secretory apparatus, giving rise to difficulties in milk secretion, would create certain conditions which may involve the development and calcification of the teeth themselves. It may, therefore, not be improbable that in the search for etiologic factors of malocclusion, a clue may also be found in the study of cases exhibiting various forms of anomalies observed in connection with internal secretory disturbances.

Special Studies.—It has been experimentally demonstrated in lower mammals that disturbances in the internal secretory apparatus bring about, besides disorders of a general nature, also structural alterations in the tooth material, modifications in the size and form of the teeth, and irregularities in the sequence of the process of dentition. These findings have also been verified by observation of various investigators in the study of similar disturbances in the human species, as in cases of rhachitis, acromegaly, cretinism, etc., where the calcium metabolic process is perverted. If, therefore, malocclusion of the teeth is merely a local manifestation, resulting simply in a derangement of the teeth in the dental arches, the dental disturbances observed in conjunction with impaired internal secretion should be either entirely absent, or only rarely, i.e., accidentally, present. If, on the other hand, occlusal anomalies *do* stand in some relationship with disturbances of internal secretion, the accompanying features observed by investigators and experimenters should also appear in this connection, and that with some constancy.

With the purpose of testing this hypothesis, the study of a number of cases was undertaken. It was of interest to learn whether the appearance of the accompanying features observed in conjunction with internal secretory disturbances is constant, and if so, what is the extent of their frequency? Also, to what degree do they develop? To make this investigation of value, it was deemed advisable to base the evidence gathered upon the following requirements:

(1) If malocclusion of the teeth is in some manner brought about through the agency of the internal secretory apparatus—which also appears to be an important factor in tooth formation—there should be noticed some demarcations on the teeth indicating structural changes that may have taken place during the course of their formation.

(2) If malocclusion of the teeth is in some way connected with internal secretion, there should be also some complications manifested in some changes in size or form of individual teeth; for, as proved by experimentation, the teeth

in ectomized animals appear modified in form or considerably smaller than those in normal ones.

(3) As disturbances in the internal secretion bring about irregularities in the sequence of eruption and shedding of teeth, it should also be noticed in conjunction with occlusal anomalies, if there is any connection between the two.

The figures obtained from the cases examined may be tabulated as follows:

Number of cases examined	Enamel defects on crowns of teeth	Anomalies in form of crowns of teeth	Irregularities in shedding of deciduous teeth		Irregularities in eruption of permanent teeth	
			Premature	Delayed	Premature	Delayed
149	65	19	37	61	32	79

As will be noticed from this table, the figures under consideration group themselves under the following headings: 1. Enamel defects on the crowns of the teeth. 2. Anomalies in form and size of the crowns of the teeth. 3. Irregularities in shedding of the deciduous teeth. 4. Irregularities in eruption of the permanent teeth.

In order to elucidate these topics more clearly, it will be necessary to treat them separately.

1. Enamel defects on the crowns of the teeth. Of the number of cases examined, 65 showed such defects. These varied in a rather wide range, showing in some cases simple indentations on the labial or buccal surfaces of certain teeth; in other cases the demarcations are so extensive as to simulate the ripples observed in cretin skulls, as may be seen in Figs. 9 and 10, while in several cases the enamel covering was markedly atypical, appearing in a very limited degree and irregularly deposited, as may be seen on the upper incisors in Fig. 11.

2. Anomalies in the form of the crowns of the teeth. The frequency with which these anomalies appear is rather moderate, and the variety large. Thus in one case there may be observed a difference in the size between the two upper lateral incisors, as in Fig. 12, while in another case a diminution in the form of a certain tooth on one side is counterbalanced by an exaggeration in size of its mate on the opposite side of the dental arch, as in Fig. 13, the first premolars; a difference in form of the second premolars may also be observed in this figure.

3. Irregularities in the shedding of the deciduous teeth. The disturbance in the sequence of dentition is very extensive, as observed in connection with occlusal anomalies. Thus, of the number examined, 98 cases showed such irregularities. By far the greatest number are noted in those cases where the deciduous teeth persist for a longer period than normal; in some cases they are observed to persist to the twenty-fifth year. The premature loss of the deciduous teeth, though not as frequent, appeared in 37 cases.

4. Irregularities in the eruption of the permanent teeth. The greatest number of cases to exhibit one particular feature was observed under this heading;

111 instances demonstrating this character. While 32 cases showed instances of premature eruption, 79 exhibited delays in this process.

Resume.—To sum up the evidence brought forth in this paper, it may be stated that, by the investigations referred to, it has been demonstrated—

Fig. 9.—Case of malocclusion, showing ripples in the enamel formation of the teeth.

Fig. 10.—Case of malocclusion, showing ripples in the enamel formation of the lower teeth.

Fig. 11.—Case of malocclusion, showing irregular deposition of enamel on the labial surface of the upper incisors.

Fig. 12.—Model of upper denture of a case of malocclusion, showing difference in size of the lateral incisors.

Fig. 13.—Model of upper denture of a case of malocclusion, showing difference in size of first premolars and difference in form of second premolars.

(1) That malocclusion of the teeth is found to be intimately related to conditions that interfere with normal breast-feeding. Of 134 cases examined, 83 per cent were found to be bottle-fed.

(2) That results obtained by experimentation demonstrate that definite

anomalies in the teeth and jaws may be produced in lower mammals by artificial disturbances created in the internal secretory glands.

(3) That a close relationship is found to exist between malocclusion of the teeth in the human being and such anomalies of the denture as are produced by experimental disturbances of the internal secretory apparatus. Of 149 cases of malocclusion examined, there were 65 malformations in the enamel-covering of the teeth; 19 anomalies in the size and form of the teeth; 98 irregularities in the shedding of the deciduous teeth, and 111 irregularities in the eruption of the permanent series.

It may therefore be concluded that of the numerous factors that enter into the etiologic problem of malocclusion of the teeth, *internal secretion* is the one which may, in a large measure, account for many mysteries that perplex the orthodontist. The appreciation of the paramount importance of this factor will be evident in proportion as more knowledge is gained with reference to the profound working of this most wonderful system of glands.

BIBLIOGRAPHY.

[1]Hellman, Milo: "A Study of Some Etiological Factors of Malocclusion." Dental Cosmos, Sept., 1914, p. 1017.
[2]Biedl: "Innere Secretion." Wien, 1913.
[3]Cushing: "The Hypophysis Cerebri." "Clinical Aspects of Hyperpituitarism." Jour. Amer. Med. Assn., 1909.
[4]Kranz: "Innere Secretion in Beziehung zur Kieferbildung und Zahnentwickelung," Deutsche Zahnheilkunde in Vorträgen, Leipzig, 1914.
[5]Virchow: Quoted after Kranz.
[6]Scholz: "Lehre vom Kretinismus," 1906.
[7]Bircher: Quoted after Kranz.
[8]Erdheim: Quoted after Biedl.
[9]Fischer, B.: "Hypophysis, Akromegalie, und Fettsucht." Frankfurter Zeitschr. f. Pathologie, 1910.
[10]Legnani and Ascoli: Quoted after Kranz.
[11]Aschner, B.· "Ueber die Funktion der Hypophyse." "Ueber Folgeerscheinungen nach Extirpation der Hypophyse." Verhandl. d. Deutsch. Gesellschaft. f. Chirurgie, Berlin, 1910.
[12]See Hellman, as under 1.
[13]Thompson, Wm. M.: Surgery, Gynecology, and Obstetrics, August, 1913.
[14]Hertogue: Quoted after Thompson.
[15]Bang: Quoted after Thompson.
[16]Almagha: Quoted after Thompson·

Pyorrhoea Alveolaris

The United States Public Health Service reports an examination of 190 cases. One hundred and eighty-seven showed the endamoeba. Eighty-seven of these were treated with emetin, but none lost it permanently. Improvement of the condition of the teeth and gums was noted in 22. Two remained stationary and one became worse. While emetin is an amoebacide, it will not alone cure pyorrhoea.

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EDITORIALS

Prosthetic Dentistry, Orthodontia, and Crown and Bridge Work

AT the meeting of the American Institute of Dental Teachers held recently in Minneapolis, the program referred to a report of a committee on prosthetic dentistry, orthodontia, and crown and bridge work. We are of the opinion that it was the intention of the executive committee of the Institute to have the the committee report on the proper method of teaching these branches in dental schools on the basis of the four-year curriculum. On receiving the program from the secretary of the Institute the question occurred to us, "What has orthodontia to do with prosthetic dentistry and crown and bridge work?" We do not claim that orthodontia is too elevated a profession to be associated with the branches mentioned, but we feel that it should not be connected with those departments from an educational or teaching standpoint. We remember the time when it was considered proper to have the professor of prosthetic dentistry teach orthodontia. That was, however, before orthodontia was practiced as a specialty and before it was considered a science as it is today. In the first place, orthodontia

has no more connection with prosthetic dentistry than oral surgery has with prosthetic dentistry; in fact, it has no more connection with prosthetic dentistry or crown and bridge work than with any other branch of dentistry. The only relation that orthodontia bears to prosthetic dentistry is that orthodontia is based on the science of occlusion, and occlusion should be the basis of all dental operations. To that extent orthodontia is related to prosthetic dentistry, and to that extent only.

Simply because there are a few mechanical devices used in adjusting the teeth, it must not be supposed that orthodontia should be classed with mechanical dentistry any more than operative dentistry is classed with prosthetic dentistry because a few instruments are used in the filling of teeth; in fact, at the present time the least work in orthodontia is the mechanical part. It is true that we have to use regulating appliances to put certain forces on malposed teeth, but those regulating appliances should be used with a knowledge of physiology, anatomy, and histology, and that knowledge should be the principal factor involved. Any appliance that does not exert force on malposed teeth in accordance with physiological laws is defective, regardless of how fine a piece of work it may be from a mechanical or constructive standpoint. Orthodontia is more closely related to histology and physiology than it is to prosthetic dentistry.

In regard to orthodontia in the dental college curriculum, it is our belief that great advancement will be made when the subject is separated from prosthetic dentistry and crown and bridge work. There may be no objection to the same man teaching prosthetic dentistry and orthodontia, but if he does, it should be because he has mastered the two subjects from separate standpoints, and not because the two subjects are correlated. Orthodontia and oral surgery are more closely related at the present time than are orthodontia and the subjects to which reference has been made. In both orthodontia and oral surgery an intimate knowledge of anatomy, histology, and physiology must be the basis of practice. In orthodontia and oral surgery certain instruments and mechanical devices are used to correct certain deformities, but those instruments and appliances are used with a knowledge of the physiology and anatomy of the parts involved. It is unfortunate for the dental curriculum, the dental student, and for orthodontia as a specialty to have the latter continually thought of as being a department of prosthetic dentistry, and not a separate science. The sooner the executive committees of dental societies, the "powers that be" in these societies, and the men associated with the management of dental colleges reach the conclusion that orthodontia must be separated from prosthetic dentistry—the same as oral surgery, physiology, and anatomy have been separated from operative dentistry—the sooner will orthodontia be taught as it should be, and the proper recognition given to it by the dental student.

Dental Libraries

DURING the past few months we have had brought to our attention the woeful lack of good dental libraries, both in the dental college and in the office of the dentist. In visiting the offices of a large number of dentists in various cities, one cannot help noticing the dental library—principally because it is so

small. It has been said, "Tell me what you read, and I will tell you what you are." That may apply to the dentists and, if we should judge them by their libraries, we would find that very few of them would be classed as dentists. In some dental offices we find quite a collection of books on subjects not relating to dentistry, but, taken as a whole, the dental and medical books are very few. Occasionally there are dentists who possess dental libraries, and these dentists are divided into two classes—the man who buys dental books to read and the man who buys books only to place on shelves. We know of several large dental libraries owned by private individuals who have made it a habit to collect dental books, but who fail to make it a habit to read them. Of course, these individuals are to be commended for their part, as in a few years the libraries will probably pass into the hands of some institutions which will make use of them.

The dental library in the dental college is practically a thing that exists only in name. It is true that dental colleges receive volumes on dental subjects from publishers, as specimen copies of such books are sent to the colleges gratuitously, to be reviewed and placed in the libraries. The college library is, however, generally given a place in the private office of some individual—the dean or secretary of the school—and carefully guarded from the eyes and hands of the student. Consequently, so far as the student body is concerned, the library in a dental college is practically of no value. There are few schools that make an attempt to procure a library for the benefit of the students, and the selection of books is, as a rule, very poorly planned. In fact, the greater number of the books usually found in these libraries will be on the subject in which the dean or secretary is particularly interested. If either of these individuals is interested in one or two special subjects, the remainder of the collection of books is very poor. Works on anatomy, physiology, and chemistry are decidedly rare in a dental library, while they should be the basic subjects on the student's course. When we consider books on oral surgery and orthodontia, or subjects which may be termed specialties of dentistry, we find those subjects are more neglected than any other.

While we realize that the question of a dental library in the dental college is a rather new phase of education, it is nevertheless a feature of educational work that must be considered, and the future of dental education depends to a certain extent on a properly selected reference library that is accessible to the student.

Permanent Staff Appointments for the Forsyth Dental Infirmary for Children

AN examination of graduates in dentistry (of less than three years' standing) for appointments to positions on the Permanent Staff for full and one-half time service will be held early in June at the Infirmary. Appointments will be made for one and two years as follows:

Full time service requiring every day, eight hours per day, with one afternoon off a week, at a salary of $1,000 per year.

One-half time service requiring three and one-half hours per day either forenoon or afternoon, at a salary of $400 per year.

These appointments will be made subject to satisfying the requirements of the Massachusetts State Board of Registration in Dentistry.

Members of this staff will be entitled to the advantages of reports and clinics by experts in the various branches of dentistry from different parts of the world, in addition to the numerous regular clinics and lectures. The operators on this staff have the advantage of the clinics and lectures of the Post Graduate School of Orthodontia.

All material and necessary operating instruments will be furnished; up-to-date apparatus including electric engines, sterile instrument trays, fountain cuspidors, compressed air and modern operating-room-type lavatories are available for use.

A diploma of service will be issued to each member of this staff who has completed this term to the satisfaction of the Trustees.

Application for the above positions should be made to Harold DeW. Cross, D.M.D., Director, 140 The Fenway, Boston, Mass., not later than May 15th. Information will be gladly furnished to anyone interested, also the date of the examination.

National Dental Association's Action Endorsed

THE following resolution was unanimously adopted at the last meeting of the St. Louis Medical Society:

Whereas, modern dentistry is an aid in the prevention and cure of many grave constitutional diseases as well as in the maintenance of general health, and

Whereas, the character of wounds about the hand and face inflicted by modern implements of war makes the services of competent dentists an indispensable aid to the Army Surgeon in time of service, and

Whereas, the efficiency of the Army both in times of peace and war depends primarily upon the physical fitness of its members, therefore be it

Resolved, That the St. Louis Medical Society heartily endorses the action of the National Dental Association in seeking such legislative enactments as will offer inducements to the better class of dentists to enter the Federal Service, and be it further

Resolved, That it petitions Missouri representatives in both branches of our National Assembly to support the efforts of the National Dental Association to secure three additional grades in the Dental Corps of the United States Army.

Heredity Versus Environment

Only by constant selection of the best can any race ever be improved. No education, no environment of any nature, can ever make any appreciable progress, even though these same favorable surroundings may produce, through ages, a definite but indefinitely slow increment, which by constant repetition becomes slowly available in heredity, but by no means fixed, so that reproduction, true to the better type, can be depended on.—*Luther Burbank.*

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ORIGINAL ARTICLES

ORTHODONTIC ENGINEERING

BY FREDERICK LESTER STANTON, D.D.S.,
NEW YORK CITY, N. Y.

LAST summer at the International Congress at San Francisco, the author presented a paper describing a dental surveying apparatus which would map the dental apparatus in three dimensions. For a better understanding of the matter that will follow, the underlying principles of this instrument and its use will be briefly described.

It occurred to the author that the problem of malocclusion could best be studied by transferring the points of interest on the teeth, gums and palate, from an accurate model of the mouth to a drawing plane. This is easily accomplished by using the dental surveying apparatus.

The principle used is that of orthographic projections which consist of transferring all points of interest in straight parallel lines vertically to the projecting plane. This form of projection is the simplest used in surveying.

Fig. 1 will illustrate the principle of orthographic projection and will also illustrate the difference between orthographic projections and perspective.

Figs. 2-*A* and 2-*B* illustrate the dental surveying apparatus and how orthographic projections are accomplished by its use. The holder (1) contains the papers on which the map is made and represents the projecting plane. The model is strapped on the surveying base (*D*). The surveying apparatus proper (*C*) is movable and the shaft is perpendicular to the platform on which it moves, and this platform is parallel to the paper in the holder (1).

The surveying point (13) and the projecting point (14) being on the movable arms (7 and 8) which constitute a parallelogram, the straight line joining them is always perpendicular to the drawing plane; and as they are moved up and down by wheel (12), this line remains perpendicular to the drawing plane in all positions. The movable part of the surveying apparatus is moved towards the model, and each point to be surveyed is touched by the surveying

point, the final adjustment being made by the millimeter wheel (12). When lever (17) is depressed, the projecting point makes an imprint on the papers in the holder, and as indicated by the dotted line in the drawing, the point touched by the surveying point (13) is transferred by orthographic projection to the papers in the holder. By this means the two horizontal dimensions are taken care of. The vertical curvature of the dental apparatus involves the third dimension—i.e., up-and-down positions, or elevations, of the teeth. These elevations are recorded in the following manner:

At the time each point is projected, its relative height is recorded on a scale which is on the upper surface of the wheel (12). A suitable card, upon which are recorded all the points of interest to be surveyed, is shown in Fig. 3. On this card are convenient boxes connecting the points surveyed. At the

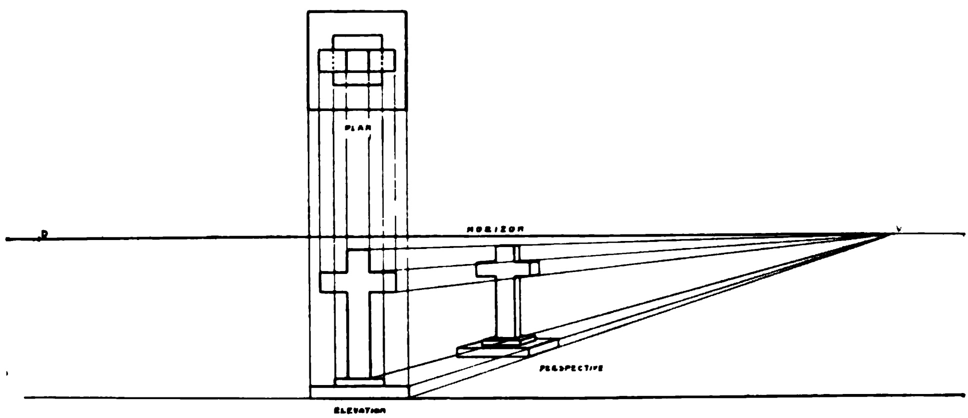

Fig. 1.—Plan and elevation are orthographic projections. Perspective is correct when eye is directly opposite vanishing point *V* and at distance *VD* therefrom.

time of projecting the mesio-buccal cusp of the upper right first molar, its elevation is noted on the wheel as 220 and this number is jotted down in the box as noted in the figure.

The author having succeeded, by means of this apparatus, in transferring to the drawing board, teeth in malocclusion, for study and measurement, there occurred to him the possibility of determining the correct occlusion of any individual from the data in hand, and from these data to make a map of the teeth in occlusion; the map of occlusion would be so arranged in relation to the crooked teeth on the map of malocclusion, that the position selected would require the least tooth movement to change the teeth from malocclusion to occlusion.

In considering bodies in three dimensions, the most convenient method of determining their position in space is to assume three fixed axes at right angles to each other. Movements of bodies are best described by giving a description of the movement in relation to these three fixed axes.

Movements are classified first as translations (bodily movements) in which all points of a body move in the same direction in relation to the fixed axes. The second kind of movement is rotation. In this movement all points in the body revolve simultaneously about a common axis of rotation, which axis can

Fig. 2-A.

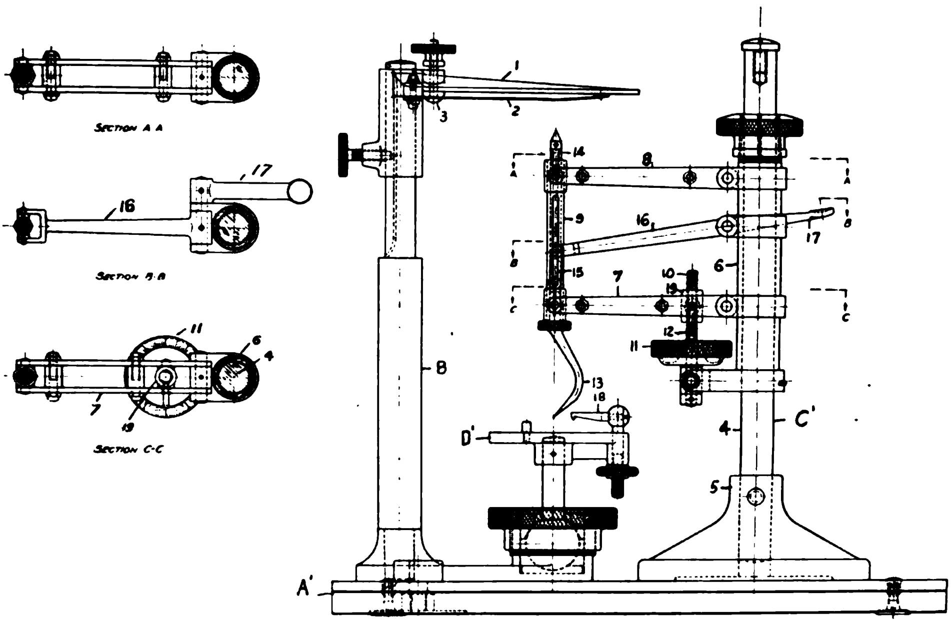
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Fig. 2-B.

be defined in relation to the fixed axes. With this in mind, it is seen that a position of a tooth can best be described by assuming three fixed axes at right angles to each other; in this way a tooth can be located in space, and any change in its position in malocclusion can then be accurately described by stating its bodily displacement (or translation), or its rotation in relation to these three axes, or the combination of bodily displacement and rotation. If the reader will turn to the latest edition of Angle,* he will find:

"A definite nomenclature is as necessary in orthodontia as in anatomy. The vagueness of descriptive terms often used renders them very inadequate. The terms for describing the various malpositions should be so precise as to convey at once a clear idea of the nature of the malocclusion to be corrected. The

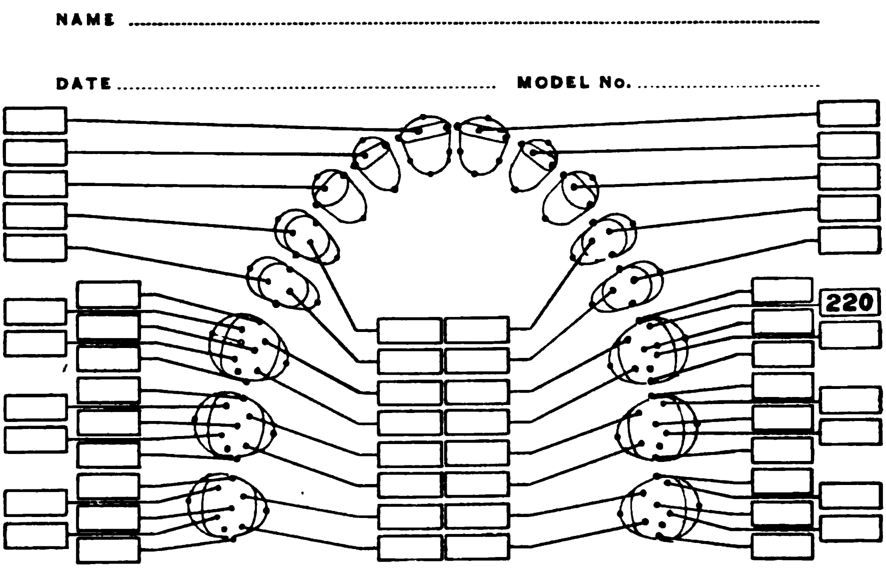

Fig. 3.

author therefore suggests the following, which, while perhaps not perfect, still seems to be a great improvement on common usage."

"For example, a tooth outside the line of occlusion may be said to be in buccal or labial occlusion; when inside this line, in lingual occlusion; if farther forward, or mesial, than normal, in mesial occlusion; if in the opposite direction, in distal occlusion; if turned on its axis, it would be in torso-occlusion. Teeth not sufficiently elevated in their sockets would be in infra-occlusion, and those that occupy positions of too great elevation, in supra-occlusion."

These ideas run through the writings of orthodontists very generally at the present time, and it is easily seen how inadequate such a classification is. This lack of conception on the part of this author (Angle) of the method of determining positions of bodies in space, has resulted in the greatest confusion in orthodontic descriptions. This author in attempting to describe the form of the dental arch, has sought to do so by describing positions of teeth in relation to a line—the line of occlusion. In his extensive work the student is told that the

*"Treatment of Malocclusion of the Teeth," 7th ed., p. 24.

basis of orthodontia is occlusion, that a full conception of the meaning of the line of occlusion must be known and appreciated, and that all deviation of tooth positions in malocclusion must be measured in relation to the line of occlusion. The possibility of an orthodontist understanding this line is discussed by Angle as follows:

"This line (the line of occlusion) describes more or less of a parabolic curve, and varies within the limits of the normal according to the race, type, temperament, etc., of the individual. It is difficult to determine exactly what the form of this line should be in each given case."

The student is told that occlusion is the goal, but no inkling is given by this author as to how he determines a line of occlusion for any individual.

It is suggested that the customary method of defining the positions and movements of bodies in space, be applied to the positions and movements of the teeth. Three axes are assumed at right angles to one another; the position and movement of a tooth may be completely defined with respect to these axes. The most convenient axes to which to refer a tooth, are the mesio-distal axis (joining the mesial and distal contact points), the buccal-lingual axis (joining the buccal and lingual surfaces of the tooth), and a so-called vertical axis, passing at right angles to the other two axes through their point of intersection.

We will now attempt to show in a practical way the application of these principles (see Fig. 4-*A*, *B*, *C*, *D*).

The upper model is placed on the surveying apparatus. It is obvious from observing the side view of this model that there is a considerable disturbance of the vertical curvature of this dental apparatus. Most models, when the teeth are in occlusion, if placed with the occlusal edges of the teeth toward a flat surface, will be very nearly on a plane from the incisors to the first molar. From that point the upper molars tip up in a gentle curve. In placing this model on the dental surveying apparatus, we assume a plane for projecting that takes into account as nearly as possible this distortion of the vertical curvature. Having done this, the points are projected by means of the dental surveying apparatus. Figs. 5-*A* and *B* are maps of the upper and lower models. Before the upper model is removed from the surveying apparatus the lower model is placed in its correct relation to the upper. With the surveying point at a convenient height to touch the lower model, two points at the left heel of the lower model are marked and projected to the upper map without changing the elevation of the surveying point. A similar point is projected from the right heel of the lower model and a point on the same plane on the front of the lower model. The upper model and the maps of the upper teeth are then removed from the apparatus. The lower model is placed on the surveying table and by means of the levelling device the four points, three on the back and one on the front of the lower model, are brought into the same plane. By this means the lower model occupies a plane similar to the one used for the upper model. Fresh charts having been placed in the holder, three registration points are projected to the lower chart. The upper model is placed in occlusion and several gum points of the upper model are also projected to the lower map to be used later for registration points.

In order to determine the occlusal relations of the teeth of the upper and lower model, the points of interest of the lower teeth and gums are now pro-

jected to the lower map. The work of the dental surveying apparatus has been completed. All that this instrument is designed to do, is to project orthographically the dental apparatus, and by means of the elevation wheel, to record the elevations of the various points. This explanation is made because the purpose of this instrument has occasionally been misunderstood; it has been thought by some that it was intended not only to survey the positions of the teeth, but also to determine the positions to which they should be moved in order to estab-

Fig. 4-*A*.

Fig. 4-*B*.

lish occlusion. The dental surveyor is simply a surveying apparatus, and its work should be judged purely from the standpoint as to whether it will or will not orthographically project the dental apparatus and by means of its millimeter wheel, accurately record the elevations of the points surveyed. The maps made by the dental surveyor can now be used for measurements or for testing the symmetry of the dental apparatus.

The author believes from the data obtained, that it is possible to predeter-

mine in three dimensions, the correct occlusion (if the sizes and forms of the teeth of an individual permit of occlusion). This can be done in one of two ways: The occlusion can be determined by a mathematical calculation or it can be determined mechanically by some instrument.

In order that the reader may understand what is meant by determining an arch mathematically, the author would state that he has no method in mind such as the Bonwill triangle or methods similar to the Hawley chart, by which assumption is made on his part that the dental apparatus is of definite form and

Fig. 4-*C*.

Fig. 4-*D*.

correlated tó measurements of certain parts of the teeth or body. His contention is that it is possible to take accurate measurements of teeth and then by mathematical calculations, take these teeth and place them in such relations that they will perform the functions of occlusion or the mutual mechanical relations of the anthropologist. He does not mean that the resultant arch will be, as Angle says, "more or less parabolic," or as Black says, "an ellipse." What the author intends to convey is this; that if the teeth of any individual should be extracted and tooth by tooth should be rearranged in wax in the best pos-

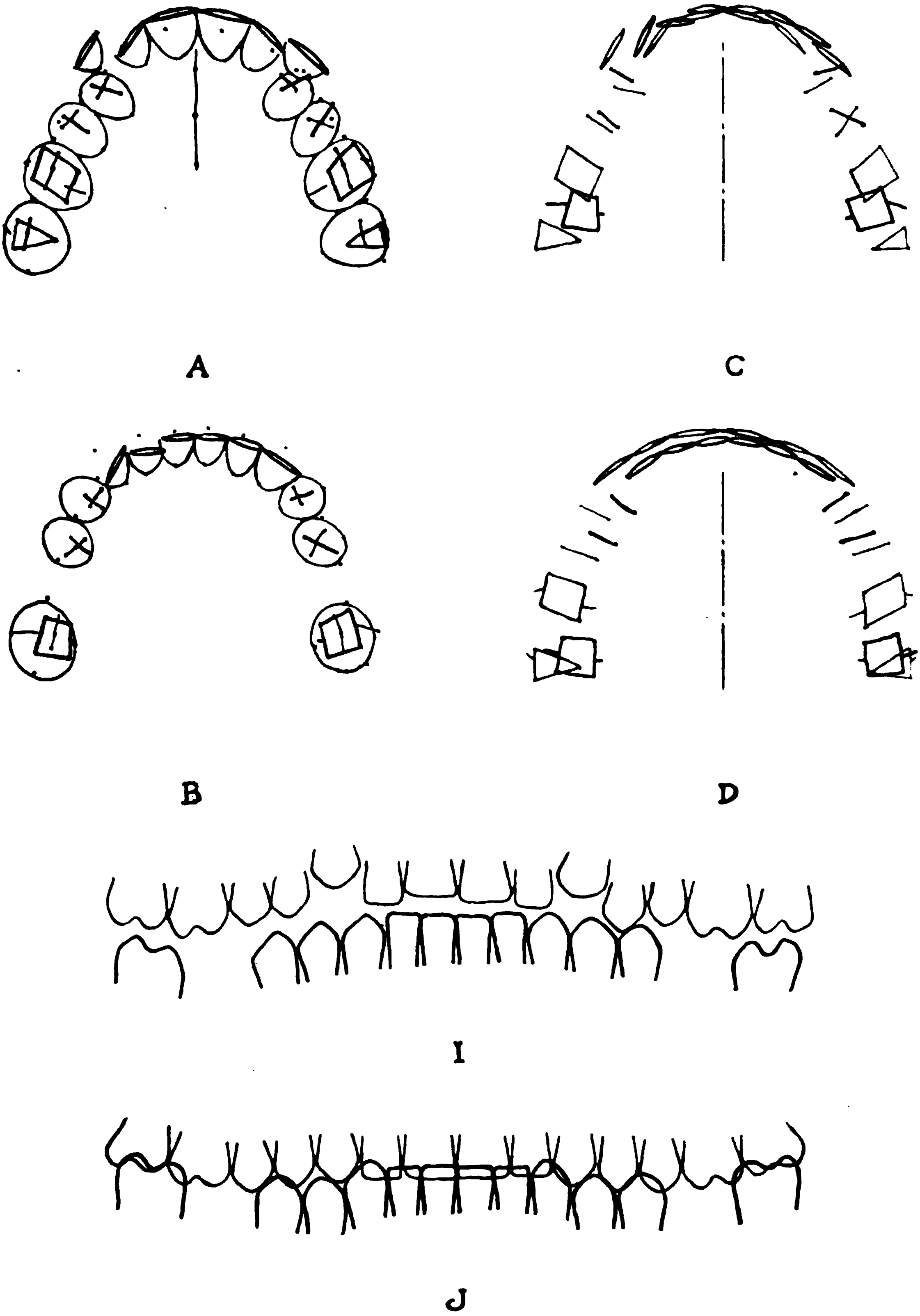

Fig. 5·*A*.

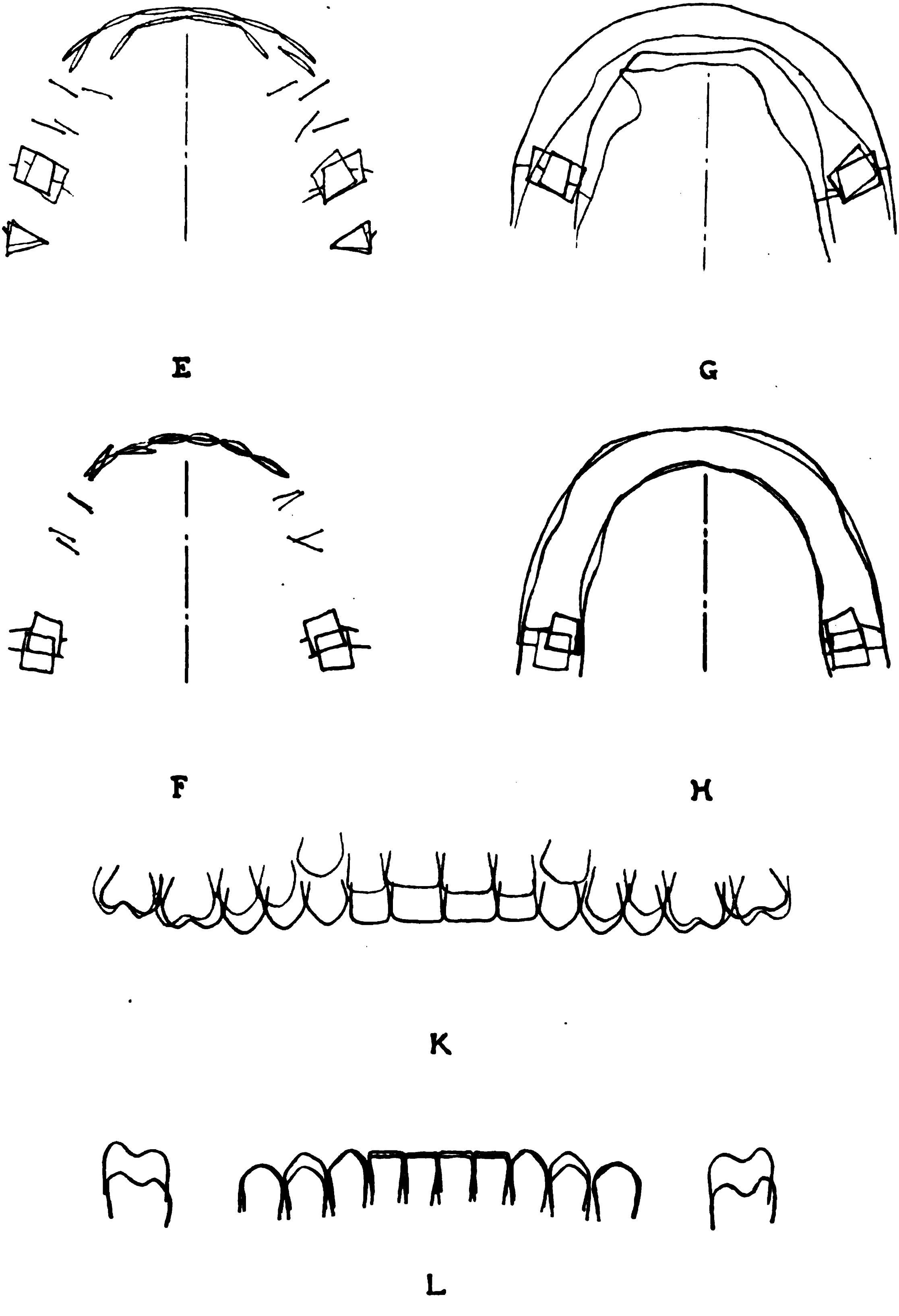

Fig. 5-B.

sible manner to produce all of the positions of the normal arrangement of the teeth of that individual, that the positions of these teeth when rearranged into the best possible form, can be determined on the drawing board as readily as if the teeth were actually in hand, and that this plan of the teeth can be graphically shown on paper.

If force should be applied to dental arches in normal occlusion and the vertical curvature remain unchanged, the cusps of the lower teeth would slide into mesial occlusion if the arches were widened, and if narrowed, the cusps of the lower teeth would slide into distal occlusion. If an arch should be designed too narrow, the occlusion could apparently be improved by increasing the compensating curve, and if the arches are made too broad, in order to approach occlusion, it would be necessary to flatten the compensating curve.

In a later communication, the author hopes to take up the subject of the vertical curvature of the teeth, but mention is made of it at this time simply to get the fact before the profession that the size and form of each dental arch of each individual is dependent upon the interrelation of the sizes and forms of the teeth of that individual.

In a paper which the author read before the International Congress at San Francisco, an outline of the various arch forms considered mathematically was presented. Since the writing of that paper, a new method of determining the arch mechanically has been perfected and by means of an instrument (the Occlusograph), the arch of any individual can be determined without resorting to mathematical calculations.

Fig. 4 shows a model of malocclusion. In this we will note the great disturbance not only of the vertical curvature of the teeth, but also in the horizontal plane, especially of the upper jaw.

Fig. 5 shows the maps made by the dental surveying apparatus (*A*, upper —*B*, lower). The registration points permit us to place the upper over the lower in proper position, and as the upper is on transparent paper, we can see the exact relation existing between the upper and lower teeth. These maps are placed under the precision-pantograph and enlarged ten times. The relations of the upper and lower jaw are shown in (*C*), the upper, red, the lower, black. The occlusograph designs the occlusion of this individual and stamps the position of the teeth as shown in (*D*)—upper in red, lower in black. The map of occlusion is then placed over the map of malocclusion and a position selected requiring the least tooth movement to change the teeth in malocclusion to their proper position in occlusion. The following figures are transferred from this map by means of the pantograph:

In (*E*) we have the upper teeth in malocclusion in red and their proposed positions in green, indicating the movement of every tooth to produce occlusion. The same is done with the lower jaw. In (*F*) teeth in malocclusion are shown in black and their proposed positions in green. In (*G*) we have the survey of the outer and inner upper gum lines in red, and the new gum lines when the teeth are moved into occlusion, in green. In (*H*) we have the deformed lower gum lines in black and the proposed gum lines in green.

We will now consider the vertical curvature of the teeth and for this purpose we make a horizontal line on transparent paper and intersect it by a straight

vertical line which we will consider the center of the mouth. From this center we lay off on the horizontal line the widths of the teeth, starting with the central incisor (right and left). For the upper teeth we draw above the line, vertical lines representing graphically the widths of the teeth. Below the line we lay off the widths of the lower teeth, drawing lines downward representing the lower teeth. In this way we will have stretched out the dental apparatus and will have shown the teeth in their correct widths, but they will not occlude. At the time the teeth were surveyed, the elevations at all points were noted.

Starting with the central incisor, we know that the elevation of its incisal edge is 261 and of its contacts 270 and 280. These three elevations are laid off on the drawing board at points *A, B* and *C,* and the tooth outline is drawn. All teeth of both jaws are similarly drawn and we have before us the dental apparatus in the third dimension. On a transparent paper of similar size, the widths of the teeth are laid off as before. Then the teeth are rearranged in their correct vertical curvature by means of the following plan:

It has been noted that the contacts of the upper jaw from the center incisor to the upper molar lie very nearly in a plane; hence the teeth are drawn in with their contacts on a plane, and commencing at the first molar, a gentle upward curvature is given. In the horizontal elevation, it is seen in this case that the arches can be formed with the usual overbite, wherefore the lower incisors are allowed to pass the uppers as shown in the drawing, and the lower bicuspids are allowed to pass the cusps of the upper to the depth of the fossæ. Having obtained this map of the correct vertical curvature of the denture, it is then moved about over the map of malocclusion and the same process is carried out as in the case of the horizontal projection; that is, the position is selected that requires the least tooth movement to change the teeth from malocclusion to occlusion.

In (*I*) is shown the denture in malocclusion, the upper in red and the lower in black; in (*J*) is shown the normal vertical curvature of the denture, the upper in red and the lower in black. In (*K*) is shown the incorrect vertical curvature of the upper denture in red, and the necessary movement is indicated by showing the correct position in green. (*L*) treats the lower jaw in a similar way, the incorrect positions in black and the correct positions in green.

Relation of the Teeth to the Eyes

SEVERAL cases are reported by Dr. Wm. E. Bruner, Cleveland, O., showing different types of ocular inflammation caused by diseased teeth with the result obtained by dental treatment. The absence of symptoms referable to the teeth is no assurance that the teeth are normal and are not the cause of the eye trouble, as in several of the most obstinate cases reported the patients thought their teeth were in good condition and had them regularly attended to by a supposedly competent dentist. An x-ray of the teeth will reveal the difficulty, and is the most satisfactory and often the only readily available method of detecting an abscess about the root of the tooth or an impaction which may be the source of the eye trouble.—*North American Journal of Homeopathy.*

THE EVOLUTION OF THE PRINCIPLES OF JACKSON APPLIANCES

By Joseph D. Eby, D.D.S., Atlanta, Ga.

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PART II.

General Review of the Evolution of Removable Appliances

WITH a few minor exceptions, the earlier forms of removable appliances consisted of a plate for a base, with various attachments for applying force. The Coffin split plate, which will forever occupy an interesting place in the evolution of appliances, belonged to these earlier forms (Fig. 1). It was a split vulcanite plate covering the palate, touching only the lingual surfaces of the teeth, relying on the linguo-cervical constrictions for retention. Connecting its halves was a double-looped spring made of 18-gauge steel (piano) wire, which, when the plate was removed from the mouth, could be bent buccally, causing a spring force for lateral development when the plate was snapped back into position. The remarkable results which were at times accomplished with this

Fig. 1.—Type of Coffin's split spring plate.

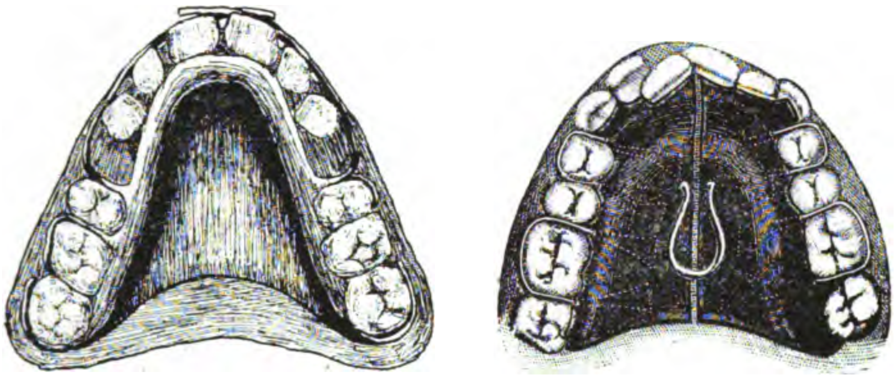
appliance caused it to become very popular, although it was very unstable and very damaging to the tissues.

Coffin was among the first of the pioneers to discover the great value of the spring force for tooth movement. There were designs of vulcanite plates, such as "spring plates"—i. e., those covering only a portion of the palate—and other plates were made to completely cover the palate and the posterior teeth continuous to the bucco-cervical borders. The "bite opening" produced was at that time considered helpful or necessary in most cases. These plates were thickened back of the teeth which were to be moved from within outward, and threaded wire screws were inserted to press against the teeth to be moved. These screws could be run up slightly at each adjustment, but there were never any assurances of force or security. For pressure from without inward, the spring wire was bent across the occlusal surfaces, which, when bent inward, produced the desired pressure, so far as general pressure was concerned, without the slightest control of details. These appliances were very inefficient, uncleanly, unstable, brittle, with the result that tooth movement was more the ex-

ception than the rule. The bulk and position which these designs occupied in the oral cavity were very objectionable.

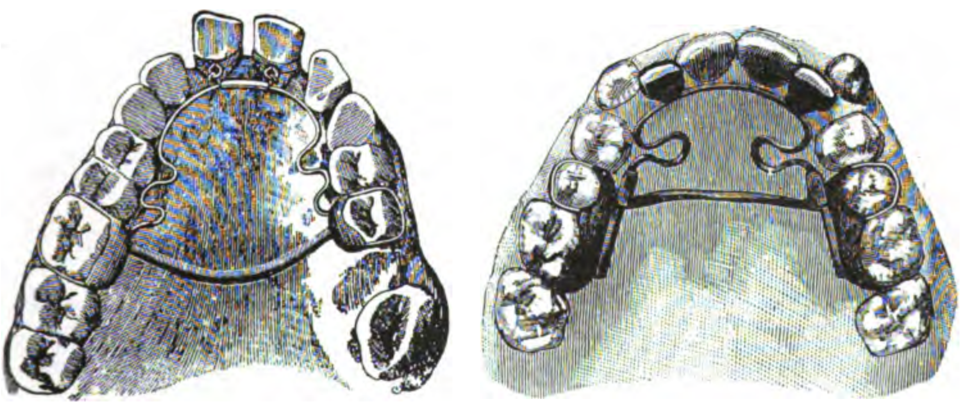
Among Dr. Jackson's earliest ideas which led to the development of his system was an improvement on these palatine plates by the addition of wire clasps made to cross the occlusal surfaces at the interproximal occlusal grooves, and to fit snugly at the bucco-cervical borders, thus gaining a secure purchase at these points.

In Fig. 2, *A* shows his addition of partially encircling clasps around the molars and *B* shows completely encircling clasps around the first bicuspids and



A. *B.*

Fig. 2.—*A* shows partially encircling clasps around the molars, and *B* shows completely encircling clasps around the first bicuspids and first molars in a split spring plate.



A. *B.*

Fig. 3.—*A* and *B* show all-metal device with clasps so constructed as to be connected across the palate with wires, from which springs are extended.

the first molars in a split spring plate. The improvement in these clasps tended toward the elimination of the bulky, brittle, uncleanly vulcanite in favor of an all-metal device, with the clasps so constructed as to be connected across the palate with wires, from which springs could be extended the same as with the vulcanite (Fig 3).

These original designs of Jackson's all-metal removable appliances were limited for the various directions of tooth movement required for the correc-

tion of all forms of irregularity, but the great range of these designs soon made it possible for a system to be perfected, governed by definite principles and adaptable to the ingenuity of the designer for the correction of all classes of irregularity. The Jackson system reached a stage of perfection between 1895 and 1900, taking the lead among the removable appliances. Having mastered the technic of these appliances, Dr. Jackson obtained the most beautiful results, and those operators who realized the superior qualities of the spring force, and the elimination of all of the many objectionable features of the "fixed" types, have adopted the Jackson system.

The weakest feature in removable appliances is the ease of removal by the patient, inviting failure by lack of co-operation. The attachments could also be loosened sufficiently to cause secondary lines of tooth movement, creating tipping, elongation, depression, etc., the same condition to be contended with in the "fixed" types, although not so severe and far more easily corrected. The Jackson system has also been subject to abuse in the hands of inefficient designers and poor technic of construction.

Through a process of continual improvements, Dr. Jackson has produced in his modern appliance a removable-fixed apparatus, which is less extensive in construction, standardized in design, and possessing the following advantages:

1. It can be easily made impossible for a patient to remove, being removable only by the operator.

2. In the case of a co-operative patient it can be carefully removed, so as to maintain an ideal degree of cleanliness, and by not touching any soft tissues it will not cause irritation or destruction of tissue, or any other temporary or permanent injury or disease which is liable to occur in the use of all other appliances. For use in simple cases, the typical removable Jackson appliance still possesses great value. In the correction of complicated cases of neutroclusion and in the treatment of distoclusion and mesioclusion the removable-fixed designs are indicated.

In considering further the new type of removable-fixed Jackson apparatus, it is necessary to direct attention to the correct principles of design and the details of technic in constructing *perfect-fitting* removable appliances. The first step in designing a Jackson appliance is to make a careful comparison of the existing malformation with the normal, and by measurement ascertain exactly the direction and amount of movement required in each individual tooth to place it in its normal position. After this the most comprehensive plan with a view of producing what will prove to be the most effective operation, is to arrange the springs as nearly as possible according to the movement of the hands and fingers, as if the teeth or the model were flexible and could be correctly aligned in this way. By this plan the Jackson appliance may be compared with the human body—the heavy wire connecting the sides representing the body, the regions on the buccal sides (including the clasps, etc.) representing the arms and all extensions from these parts in the form of springs being compared with the digital movements of the fingers. By grasping a model after diagnosis is complete, and "rehearsing" the tooth movement as it would be made with the fingers, the most effective design of the Jackson appliance will usually be suggested.

INSTRUMENTS.

The instrumentation for Jackson appliances consists of short, straight-ended scissors, combination punch and contouring pliers (S. S. W. No. 112), straight,

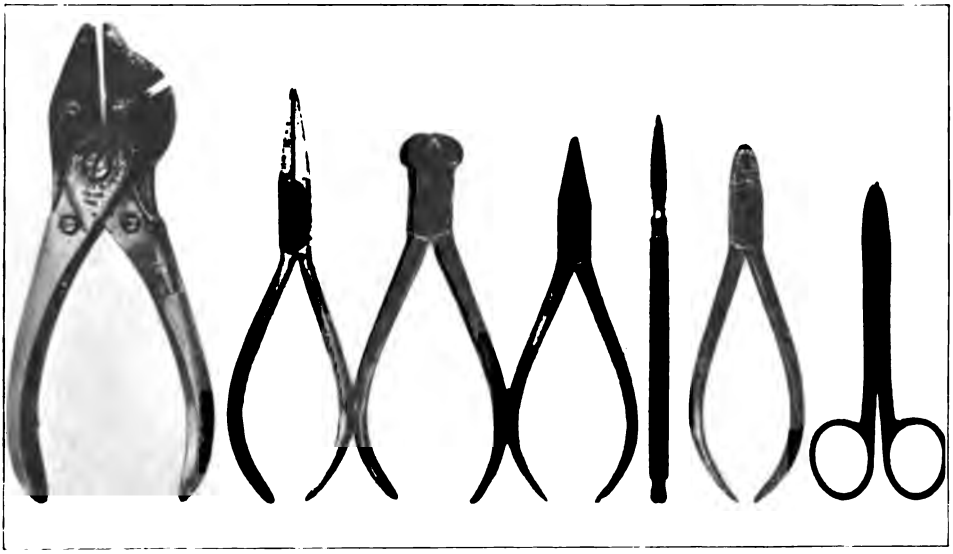


Fig. 4.—Instruments used in technic.

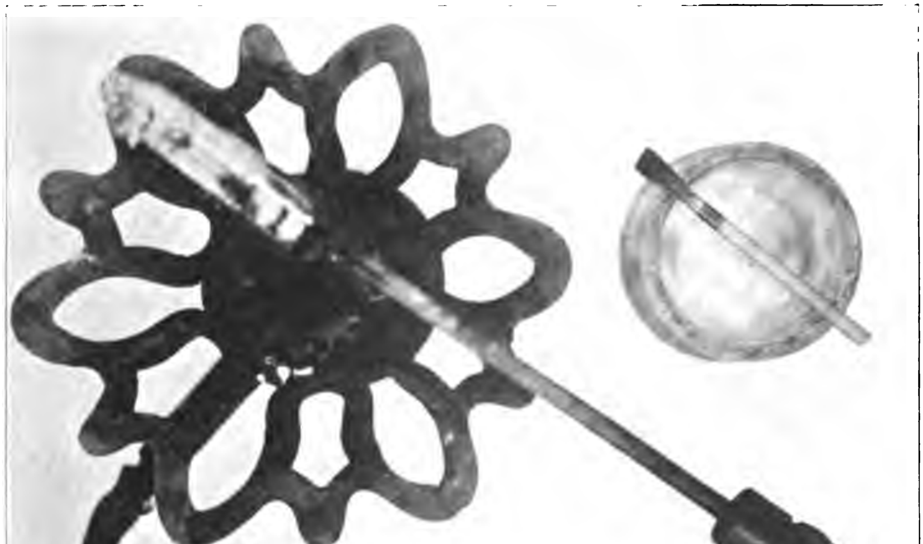


Fig. 5.—Soldering equipment, consisting of a brush burner and a 1-pound pair of soldering coppers.

flat-ended instrument for adaptation, wire cutters, long-nosed or "office and laboratory" pliers, very small-ended, round-nosed pliers, and parallel pliers (Fig. 4). There are no other pliers which can be properly substituted for the S. S. W.

No. 112 contouring pliers in contouring the plates for the lingual surfaces of the anchor teeth. All other contouring pliers will undercontour or overcontour and crimp the strips, whereas these particular pliers will contour a uniform concavo-convex plate, subject with ease to perfect adaptation to the lingual surfaces.

The round-nosed pliers are to be used for practically all wire bending, and should be very small at the end for very accurate bending. The ends of these pliers can be made small by clamping them in a vise *with the jaws of the pliers closed,* and with a strip of emery cloth uniformly reduce the exterior diameter of the points. Parallel pliers for heavy wire bending, with the side cutters, for wire cutting, are indispensable.

The soldering equipment (Fig. 5) consists of a brush burner and a 1-pound pair of soldering coppers. These irons should be pure copper, as the composi-

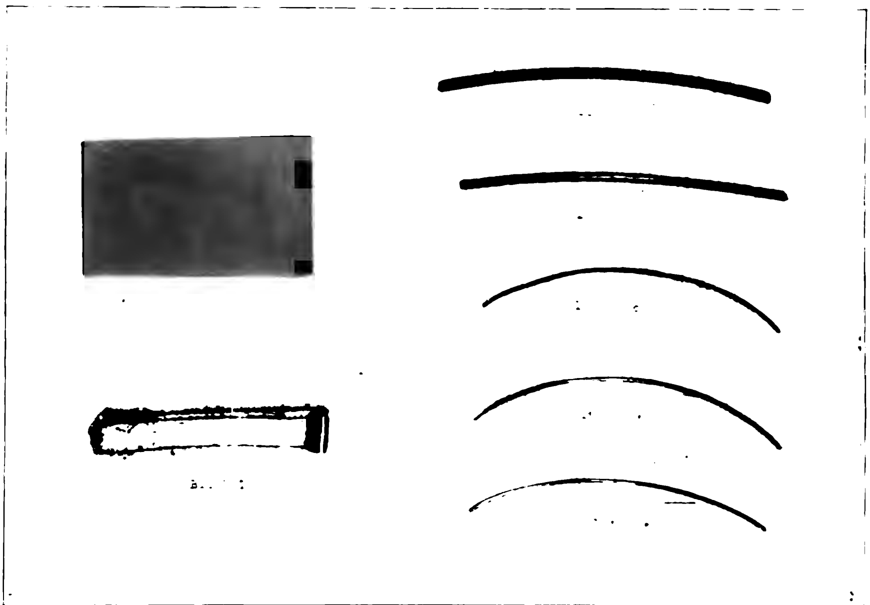


Fig. 6.—Materials used in technic.

tion metal iron will oxidize more rapidly, will pit, and will not control block tin accurately. Irons smaller than the 1-pound pair (½ pound each) burn rapidly, and do not hold heat long enough, and larger irons are too clumsy and require too long to heat.

The flux is a saturated solution of zinc chloride, to be applied abundantly with a camel's hair brush. This solution can be made better than that which is usually bought by pouring hydrochloric acid (C. P.) slowly over zinc globules. Zinc should remain in excess, as the free acid will attack the metals. This solution is kept in a large-mouthed vessel (Fig. 5) in order that the iron may be kept perfectly tinned by immersion of the point after each heating.

MATERIALS.

The first material to be mentioned is Jackson's partial clasp metal, 36-gauge (Fig. 6). This is a specially prepared stiff material, not to be annealed, which

responds to the contouring pliers, but is so resistant to bending that it will not yield to stresses brought against it in the acts of manipulation of the appliance. This metal has been treated on one surface to gain a very tenacious attachment with tin, and it is impossible to scale off the plates when made of this special metal. All other substitutes—such as low karat gold, copper, bronze, platinoid, German silver, silver, or brass in any form—cannot be used with success as they lack one or both of the essentials of hardness and secure attachment in the solder. This metal possesses a gold surface for contact against the enamel.

The wire used is an alloy of nickel silver, as springy as possible and also bendable (Fig. 6). The gauges required are: Nos. 20- and 21-gauge for clasps, Nos. 18- 19 and 20-gauge for finger springs, and Nos. 10- 11- and 12-gauge for connecting body wires. This material can be purchased at supply houses. The solder must be the purest block tin (Fig. 6). Manufacturers market block tin which abounds in arsenic and is slightly irritating, and the best tin procurable is the high-test tin used in the making of alloys. "Half-and-half" soft solder should *never* be used.

In the next issue will appear the illustrated construction of Jackson appliances for lateral and forward development.

"Dental Hygienists"

MORE and more the importance of dental hygiene, particularly for school children, is being recognized. In a recent address at the Forsyth Dental Infirmary for Children, the director of that institution emphasized the dangers of poor teeth in school children both for themselves and for others. "All must share in the morbid pathological conditions of the neglected child, and this is particularly true concerning tooth and mouth conditions. The time is rapidly approaching when a child will not be allowed to enter a public school until he is physically fit." Even disease of the first teeth, which have been too often disregarded because of their transient nature, is capable of producing lasting effects upon the child. When the temporary teeth are lost prematurely, the permanent teeth erupt unassisted into various conditions of irregularity and malocclusion, which greatly interfere with the growth of bones of the head. Deformities of the nose and mouth may result, which interfere with respiration and with voice production. Absorption from septic processes in the mouth has been much discussed of late.

Granting the truth of these facts does not settle the problem. The question of how to get so many thousands of mouths cared for, presents a number of difficulties. The interest recently aroused in dental hygiene has flooded the dentists with work. Many people cannot afford regular dentists' fees for cleaning, and the elementary part of the work, which is sufficient for the teeth of many children, should not require the time of a dentist.

Laws dealing with this situation have been enacted in Massachusetts and Connecticut, and now the Governor of New York State has recently signed a bill which provides for the training, registration and licensing of the "dental hygienist." The new law provides that any dental dispensary or infirmary, legally incorporated and maintaining a proper standard and equipment, may establish for women students a course of study in oral hygiene. One year's attendance at high school and one year's training in oral hygiene are required to become a licensed "dental hygienist." The person so licensed "may remove lime deposits, accretions, and stains from the exposed surface of the teeth, but shall not perform any other operation on the teeth or tissues of the mouth."

It is to be hoped that plenty of "dental hygienists" will be developed and that the portion of the public, who heretofore have been unable to afford dentists' services save for the worst toothaches, will appreciate the value of clean mouths and avail themselves of the opportunity.—*Boston Medical and Surgical Journal.*

THE EVOLUTION OF THE TREATMENT OF DISTOCLUSION*

By W. G. Barr, D.D.S., Wichita, Kansas.

As a result of the advancement of orthodontic methods in the past few years, the treatment of no other class of malocclusion has passed through such evolutionary stages as that of distoclusion. From the study of orthodontic literature, as has been taken up by Dr. Weinberger, it is very readily shown that certain conditions, which we now recognize as distoclusion, must have been recognized very early in the history of medical science. I do not, however, care to take up your time by going into the various ancient methods of the treatment of this condition, which is also known as Class II, Division 1, but the protrusion of the upper central incisors was recognized very early, and such protrusions undoubtedly were associated with distoclusion as we know it today.

If we simply take up what might be termed modern orthodontia, we will find at least four different plans of treatment which have been advocated in the last ten years, and one or more of these plans are still followed by some men. Those of us who have had any experience realize that the majority of our patients with distoclusion and labioversion of the incisors, or Class II, Division 1, cases, come to us primarily to have the protrusion of the upper incisors corrected. A great many of them do not understand that the real, serious condition exists in the distal relation of the lower dental arch along with the underdevelopment of the mandible, which accompanies such types of malocclusion. It is the symptom of the labial protrusion of the upper incisors that causes the majority of patients to seek relief. It is, therefore, logical to conclude that the early treatment of distoclusion was directed toward the symptom rather than toward the treatment of the condition. While it is a fact that the relation between mouth-breathing and distoclusion was recognized very early by the dental and medical professions, it is also a fact that it was comparatively only a short time ago that these two professions began to comprehend the correlation which existed between the orthodontic and rhinological treatment of those cases, and it is for this reason that one of the earliest plans of treatment of distoclusion consisted in the retraction of the upper anterior teeth. In other words, the plan may be stated as consisting of the reduction of the size of the upper arch to make it harmonize with the lower arch, and has for its object merely the improvement of the occlusion and restoration of harmony in the sizes of the arches. While this statement is not exactly anatomically correct, nevertheless the upper anterior teeth were moved distally after the extraction of the first premolar on each side and made to harmonize with the lower anterior teeth. Now, this line of treatment appealed to a great many patients because the protrusion was the objectionable feature. They did not know that the distal movement of the upper incisors would produce a facial deformity equally as obnoxious from an artistic standpoint as the protrusion of the upper incisors; they did not understand that, by retracting the upper anterior teeth and mak-

*Read before the Sixth Annual Meeting of the Alumni Society of the Dewey School of Orthodontia, Kansas City, Mo., February, 1916.

ing them conform to the lower anterior teeth, there would be produced a facial deformity equally as undesirable as the first. In fact, one facial deformity was created in an attempt to correct another. The facial outline obtained by such a treatment may at first seem to be an improvement, but it is inclined to become more objectionable as the individual grows older. Owing to the abnormal position of the anterior teeth in such cases, the muscles of expression, especially the orbicularis oris and labial muscles, are in such a position that the expression of the face is always very unpleasant. The mandible, being underdeveloped because of the distal relation of the lower teeth, always remains underdeveloped if nothing is done to cause it to develop forward.

This type of treatment may be said to have for its object the reduction of the anterior teeth without any idea as to the improvement of the occlusion of the molars and premolars. Nothing is done to improve nasal breathing because the upper arch is not expanded; nothing is done to produce the development of the

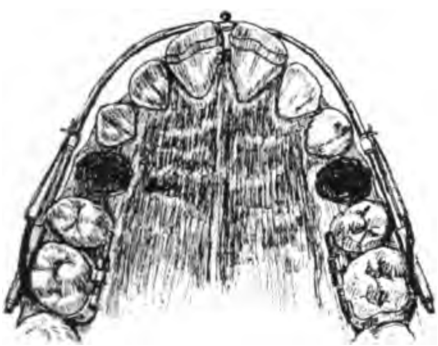


Fig. 1.

Fig. 2. (After Angle.)

mandible because no effort is made to move the mandible forward. Of course, with this plan of treatment,[1] occipital anchorage (Figs. 1 and 2), is employed to move the upper anterior teeth distally. An objectionable result of this treatment is the excessive overbite, which is always produced by the distal movement of the anterior teeth without moving the lower arch forward (Fig. 3). While this plan of treatment is not adopted to any great extent by many orthodontists at the present time, still the plan is being followed by some in the dental profession, and is even being advocated by a few orthodontists as the proper treatment for extreme labioversion of the upper incisors. We know that this plan of treatment is the oldest that was used for distoclusion, and which, by the way, did nothing to correct the defect, but simply dealt with one of the prominent symptoms.

What I believe to be the second distinct plan in the evolution of the treatment of distoclusion was the method originated by the late Dr. Norman W. Kingsley, which became known to the dental profession as "jumping the bite."

[1]Angle: Malocclusion of the Teeth, 6th ed., p. 235.

While there is no question that Dr. Kingsley appreciated the occlusion of the teeth, especially from an artistic standpoint, he has laid very little stress in his writings on the normal occlusion of the teeth as a factor in the masticating efficiency of the teeth. It seems as if his idea in the treatment of distoclusion was to devise some plan which would improve the facial outline to a greater extent than the method that was being followed up to that time as the universal practice.

Dr. Angle, in the sixth edition of his work,[2] says: "The second plan of treatment is toward the ideal—the establishing of normal occlusion, normal relations of the dental arches, and normal facial lines, as we have already noted." This plan of treatment had for its object the expansion of the upper arch, the reduction of the protrusion of the anterior teeth, and the forward movement of the mandible, thereby establishing normal occlusion and improving the facial outline by the forward movement of the mandible. This plan consists in the expansion of the upper arch and the retraction of the anterior teeth by means

Fig. 3.

of a skull cap, the expansion of the lower arch so as to place each tooth in its proper position with the line of occlusion, and then the forward movement of the mandibles by the voluntary action of the external pterygoids. Dr. Angle says: "This means the retention of all the teeth, the restoration of each to harmony with its line of occlusion, the changing of the teeth from distal to normal occlusion by moving the lower jaw forward and compelling normal closure of the jaw by some form of device until normal occlusion shall have been thoroughly established, and the jaws and muscles, and especially the temporo-maxillary articulation, shall have been modified into this changed occlusion." By this plan much better facial outlines were obtained than was possible by the older plan, because this plan was actually the treatment for distoclusion, and overcame, to a certain extent, the underdevelopment of the mandible by its forward movement, thereby bringing the chin forward—very nearly, if not entirely—to its proper position. By this method certain conditions known as "before and after results" could be obtained very readily, for there was no question about securing the expansion of the upper arch and the retraction of the

[2]Angle: Malocclusion of the Teeth, 6th ed., p. 247.

anterior teeth by means of a skull cap; neither was there any difficulty in expanding the lower arch, and there was no difficulty in having the patient move the mandible forward by voluntary muscular action. So far as the treatment was concerned, we might say that it was very simple.

The difficulty, however, which arose was the matter of retention. In fact, Dr. Kingsley contended up to the time of his death, that retention was the problem of orthodontia. He claimed that teeth could be moved to almost any position, almost any distance, but stated that the perverseness of inanimate objects to return to their former positions was something that would always have to be contended with. Part of his argument for considering retention a problem was probably because with this plan of treatment, which was called "jumping the bite," the holding of the mandible was a very difficult procedure. How to secure retention was the question, and it was a problem because the treatment, as outlined here, was not along anatomical lines. The treatment will remove the difficulty, overcome the facial deformity, and correct the distal relation of the dental arch, but, in doing so, certain parts are thrown on a stress or strain, which makes it very difficult to retain them in position. By that we mean that in the forward movement of the mandible the head of the condyle leaves the glenoid fossa and rests on the eminentia articularis, with the result that the fibers of the external capsular ligament are placed on a strain. In the same manner the fibers of the temporal muscles, which are so constructed that, when they act, the mandible is moved distally, are always struggling and pulling to bring the mandible back to the old position during the process of mastication. The other ligaments in the temporo-mandibular articulation—namely, the spheno-mandibular and stylo-mandibular ligaments—are also on a stress, for, when the mandible is protruded, they are necessarily put on a strain because their attachments are moved forward, which has the effect of shortening the ligaments, and pulling the condyle up against the interarticular cartilage and compressing it between the eminentia articularis. For that reason, after the mandible has been moved forward by voluntary action and attempts are made to retain it, there are active forces continually struggling to pull the condyle distally, and therefore it requires a continual effort to keep the mandible forward; if the mandible is not kept forward, of course, the dental arch will also return to its old position. Part of the trouble in retention was on account of the faulty means employed for the purpose at that time, the retaining appliances being of a weak variety, and generally with very insecure anchorage (Fig. 4). As a result, the appliances were constantly breaking, the mandibles drifting back, and the teeth resuming old positions. Some cases appeared to be successfully treated by this plan because the appliances retained the teeth, but it is the belief of the writer that the condyle eventually slid back to its old position. There were strong arguments pro and con for this plan of treatment, and owing to the improved facial results which were occasionally obtained by this new plan, it was continually tried, with more or less success, by men who had a high appreciation of artistic results. But, on account of the difficulty of retention encountered in the second plan of treatment, known as "jumping the bite," and because of the unsatisfactory results from a facial standpoint, obtained by the first plan, a certain number of men were continually making efforts to perfect

a technical procedure which would overcome some of the objections of the two plans.

With the publication of Dr. Angle's work on malocclusion and the founding of his school, a method of treating distoclusion was developed known as the Baker anchorage. It will probably not be amiss to give a short history of the Baker anchorage, which has been described as various forms of intermaxillary anchorage, but to Dr. Baker, of Boston, belongs the credit of having brought to the attention of the dental profession a plan which, with certain modifications, has been revolutionary in the treatment of distoclusion. Up to the time of Dr. Baker's description of his use of his intermaxillary rubbers, the profession knew very little about reciprocal intermaxillary anchorage. Now, it is probable that Dr. Baker was not the first one to use intermaxillary anchorage, but it was he who brought it to the attention of the profession—not so much through his writings as by the literature of Dr. Angle and some of his students. Intermaxillary anchorage as used by Dr. Baker, was very crude compared with intermaxillary anchorage of today (Fig. 5), but it was the beginning of the scientific treatment of distoclusion, and his work and the plan as explained by

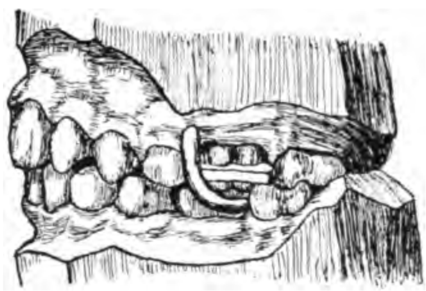


Fig. 4. (After Angle.)

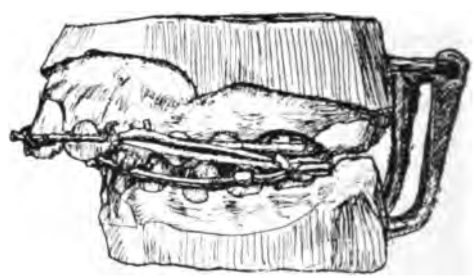


Fig. 5.

Dr. Angle in his seventh edition may be said to be the third plan of the treatment of distoclusion. This plan was not devised entirely from an anatomical standpoint, nor was it intended to completely remove the pathological conditions as they may exist, but it was devised more to overcome the difficulties which were encountered in the previous two plans of treatment and present a procedure which would be much more simple and be scientifically correct from a mechanical standpoint.

It has been stated that the objection to the plan recommended by Dr. Kingsley, known as "jumping the bite," was the difficulty of retention on account of the condyle "insisting" on moving back into the glenoid fossa after the mandible had been moved forward. With the use of the Baker anchorage, as described by Dr. Angle in his seventh edition, an effort was made to shift the mesio-distal relation of the teeth and avoid a forward movement of the mandible. It was the belief that by shifting the position of the teeth and bringing the inclined planes in proper relation, there would be a development of the mandible, which would tend to overcome the facial deformity which was present in those malocclusions. The object of this plan was the distal movement of the upper incisors and the enlargement or expansion of the upper arch, as well as the distal movement of the molars and premolars of the upper arch.

The lower dental arch is moved forward about half the width of the premolar, and, as the upper teeth have been moved backward half the width of the premolar, there would be a normal mesio-distal relation of the teeth to each other, with the result that there would be more or less tipping of the upper and lower teeth. The forward movement of the lower teeth improved the facial deformity to a certain extent, but the distal movement of the upper molars and incisors beyond what is now believed to be the anatomical position in the majority of cases produced a facial outline which was not very pleasing. In a number of cases treated by this plan it was found that, while a great improvement of the facial outline was produced, the position of the mandible, so far as mesio-distal relation was concerned, was not exactly what it should be, although in some of the cases, where the mesio-distal relation of the teeth remained normal, there was a development of the mandible, which, to a certain extent, overcame the deformity or lack of development which existed immediately after treatment. The retention in the cases treated by this plan was not as difficult as the retention in the cases treated by Dr. Kingsley's method, known as "jumping the bite," because the teeth had been moved only in their processes, and that was all that was required. The mandible, having remained in its proper position so far as the condyle was concerned, did not require any retention to prevent the condyle from slipping back in the glenoid fossa. The retention in these cases, when this plan of treatment was first used, was not, however, as easy as might be supposed, owing to the faulty method of retention which was employed.

Of these three plans of treatment, passive intermaxillary retention was the kind which was usually employed; in fact, so far as I know, it was the only plan or type of retention which was used for a number of years. The experience with this kind of retention, which consisted in the use of some form of the plane and spur, led Dr. Watson to make the statement several years ago that while we could regulate teeth with a certain degree of nicety, move them practically where we desired, we nevertheless encountered great difficulty in retaining them. In other words, in the evolution of the treatment of distoclusion the theory of treatment progressed much more rapidly than the fact of retention, and this condition prompted various persons to endeavor to develop some practical method of retention.

Law, of Berlin,[3] and Dewey began working on a certain principle of procedure at about the same time, the two methods being somewhat similar, and a little later, Watson, of Detroit, read a paper before the American Society of Orthodontists on this subject, referring to retention as a problem, which indicated that practical retention was not a success at that time, as the men engaged in the development of a new method were working along different lines. As a result of the work of these men, active intermaxillary retention was finally evolved, which was the simplest method that could be adopted, for it can readily be understood that if a certain force is used to move a tooth, the same force is necessary to retain it, and therefore the intermaxillary rubbers which have been used in tooth movement are now employed in retention. Of course,

[3]The Retention of Class 2 Cases—The Staple and Hook Sectional Retainer. A paper read before the European Orthodontia Society. Published in the American Orthodontist, Vol. i, No. 4.

this was a revolutionary principle so far as the old idea of retention was concerned, for it had been held in times past that in order to retain a tooth it must be held rigid. It is now the opinion of men of experience, among them Dr. Noyes, whose reputation as a histologist is beyond question, that the way to retain a tooth is not to hold it rigid, but to hold it in such a position that it will respond to all the forces of mastication, or what is now known as the "forces

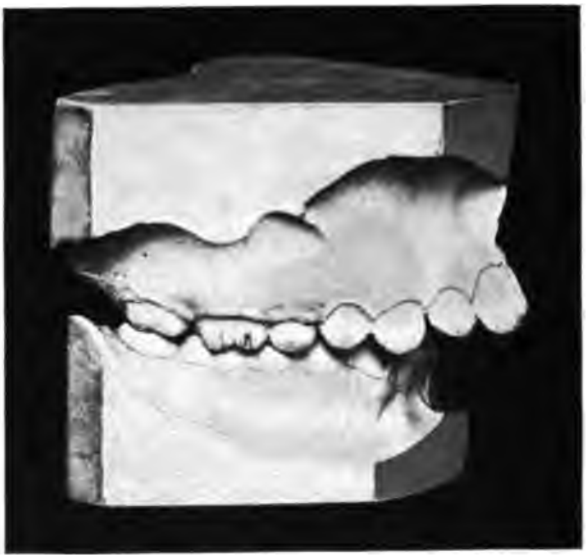


Fig. 6.

Fig. 7.

of occlusion." Retaining appliances are divided into active and passive devices and the forces of retention are divided into natural and mechanical. Mechanical retention is only a means of assisting the natural forces, and therefore retention, after the treatment of distoclusion, is more easily secured.

With this third plan of treatment, after retention had been worked out, it was still the desire of some men to have a greater facial improvement than had

been previously obtained. A treatment, based entirely on the pathological conditions as found in this class of malocclusion, and with the aid of regulating appliances now obtainable, was therefore devised which had for its object the elimination of all the deformities and pathological conditions which a case may present.[4] In other words, that treatment was to produce a normal occlusion

Fig. 8.

Fig. 9.

with a normal facial outline. If one will consider this matter for a few minutes it will be realized that the pathological conditions found in this type of malocclusion are distoclusion and labioversion of the upper incisors—or, in other words, Class II, Division 1 (Fig 6)—consisting in an underdeveloped mandible,

[4]See treatment of Class II, Division 1, Practical Orthodontia (Dewey).

with a distoclusion of the lower arch, a narrow upper arch, and protruding upper incisors, abnormal lip action, and abnormal breathing (Fig. 7). The breathing must be treated by rhinological interference. Taking each arch separately, the treatment of the upper arch should be its expansion and moving distally the incisors, so as to make a normally shaped dental arch. As the upper molars and premolars are not forward in the majority of cases, no effort should be made to move them distally. In this plan we notice that the differ-

Fig. 10.

Fig. 11.

ence between this treatment and the one outlined by Dr. Angle in his seventh edition is the manner in which the upper dental apparatus is treated. The attempt is then made to move the lower teeth forward the entire distance, or move them from the position of distoclusion to one of normal occlusion as compared with the upper teeth. This means a forward movement of the lower arch practically twice as far as recommended by Dr. Angle. The forward

movement of the lower arch causes the development of the mandible, which development is in the body of the mandible and not produced by a forward movement of the condyle. Realizing the difficulty that Dr. Kingsley encountered with his plan of "jumping the bite," we have planned to avoid such a condition, and, believing that we can get a development of the body of the mandible by the proper application of mechanical force, we endeavor to obtain that development by using intermaxillary rubbers to move the teeth forward.

The objection to the third plan of treatment was that it produced too great a

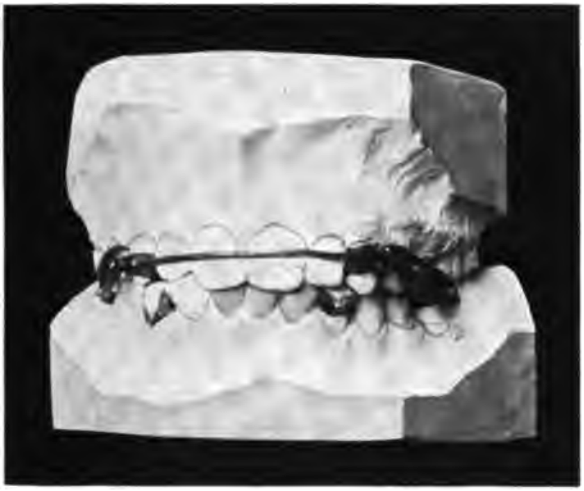


Fig. 12.

Fig. 13.

tipping of the molars and premolars; but, with the proper application of force, which may be produced by putting spurs on the front part of the lower arch to prevent the tipping of the lower incisors, or by a slow movement of the lower teeth, depending on the occlusion to keep them straight, we are able to move the lower arch forward the entire distance and still preserve the teeth in an upright position. In adjusting the mechanical appliances to produce such a tooth move-

ment, the alignment wire is first adjusted on the upper dental arch, with the wire resting against the incisors in the anterior region, and the nut being away from the tooth on the molar band (Figs. 8 and 9)—that is, the initial force of the intermaxillary rubbers must be exerted directly upon the upper incisors, with the canines ligated to the alignment wire in such a manner as to expand them (Fig. 10). After the arch has been expanded in the canine region and the incisors moved distally, the nuts on the upper alignment wire are allowed to rest against the tubes on the upper molar bands. All the upper teeth are then ligated to the alignment wire to produce as much resistance as possible, which resistance is required to move the lower dental arch forward. In moving the lower arch forward, the teeth are brought forward in mass (Fig. 11)—that is, the molars, premolars, incisors, and canines are moved forward at the same time—and any expansion which may be required is also produced at that time in order that the lower arch will fit the upper arch when the lower teeth have been moved forward.

Now, this plan of treatment differs from other methods practiced by some

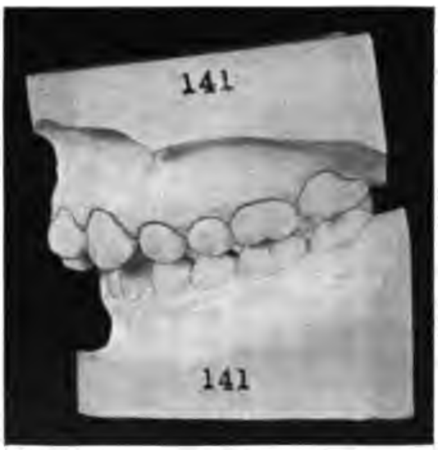


Fig. 14.

Fig. 15.

men in that they would first move the incisors and canines forward in the lower arch, then the premolars, and, lastly, the molars. The objection to the plan of moving the teeth forward in sectional groups is that it prevents the approximal contact of the lower arch, needlessly destroys a large amount of alveolar process by causing absorption and rebuilding, and, to a certain extent, lengthens the time of treatment. If the necessary resistance is obtained in the upper arch with the proper application of the alignment wire, it is possible to move the entire lower dental apparatus forward at one time, thereby preserving the approximal contact and keeping the teeth in a much better position, making it easier to retain them than if they had been moved in groups. After the teeth have been moved, they are, of course, retained by active intermaxillary retention, which consists of a lingual arch on the lower teeth, with the use of a labial arch in the molar and premolar region above, and a fine bar running labially to the upper incisors (Fig. 12). In this plan of treatment we almost invariably

elongate the lower molars, which is to be desired, for the reason that the majority of distoclusions, with labioversion of the upper incisors, are complicated by an infraocclusion of the molars. By moving the teeth forward, there is a tendency for the lower molars to be elongated, and as stated, this elongation is desirable, as it also has a tendency to produce a development of the mandible, increasing the length of the lower part of the face (Fig. 13). By examining results obtained in this plan of treatment with patients of various ages, it has been found that a much better facial effect is obtained, as the object is to remove the prevailing pathological conditions and thereby establish normal occlusion and normal facial outline. Case No. 141 (Fig. 14) is a distoclusion which was treated by this method and Fig. 15 shows the finished results.

The full report of a class of distoclusion in which the fourth plan of treatment was employed was published in the *International Journal of Orthodontia,* November, 1915, to which those interested are referred.

A REPORT OF A CASE TREATED WITH THE PIN AND TUBE APPLIANCE

By Walter H. Ellis, D.D.S., Buffalo, N. Y.

THIS case report is intended to show the superiority of the Angle pin and tube appliance over the older form, that of the plain arch and ligature wire, where the bodily movement of the teeth is required. Not only was the bodily movement of the incisor teeth necessary, but the apices required moving farther than the crowns.

The upper model shows the case before treatment. The second model shows the same case after the use of the plain arch and wire ligature for five and one-half months. The result was the best possible with that appliance. Note the decided slant of the incisors and the lack of development in the apical region,—truly a great opportunity for "bone growing."

At just this time in the treatment, Dr. Angle gave us his new technic for bodily tooth movement. The pin and tube appliance was adjusted and after its use for twelve months, the result as shown in the lower model was obtained.

This case is, in my estimation, a very graphic illustration of the superiority of bodily movement of teeth in this type of case.

THE HISTORY OF ORTHODONTIA

(*Continued from page* 211.)

BY BERNHARD WOLF WEINBERGER, D.D.S., NEW YORK CITY.

FREDERICK HIRSCH (1799), in his *"Correction of Dental Anomalies,"* relates a case in which the deformity consisted of the union of two central incisors forming one single piece, resembling a paddle, and spoiling the appearance of the face. He divided them with a saw, cauterized the surfaces of the sections, scarified the gum, and to gain a little space, introduced a small

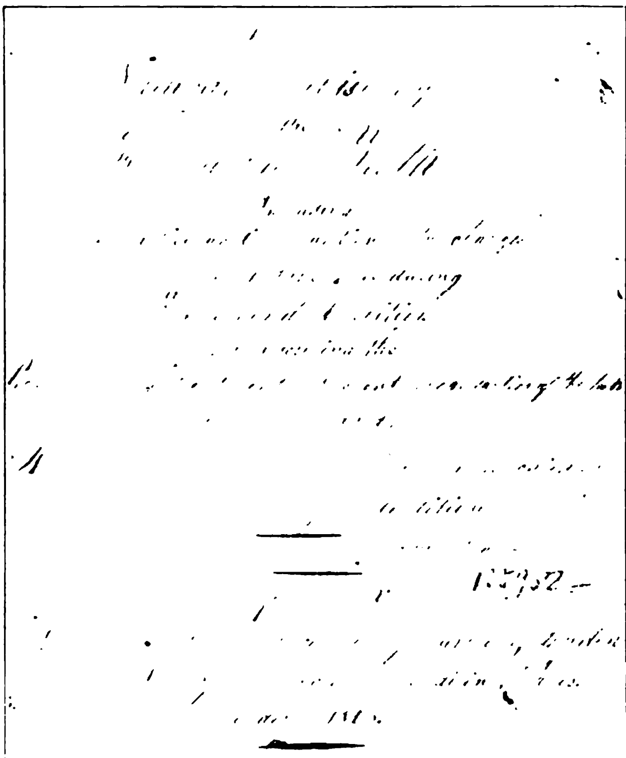


Fig. 1.—Title page. Joseph Fox, "Natural History of the Human Teeth," etc., 1803. From the original manuscript, Surgeon-General's Library, Washington, D. C.

wedge, until the gum had grown up within a new dental interstice, thus giving an altogether normal appearance to the part.

J. Arneman (1801) described the changes due to the growth of dental arches, claiming that the deciduous teeth should never be extracted, but be allowed to remain until the permanent teeth take their place, for it was the increased size of those teeth that created growth; that if the deciduous teeth were removed too early lack of development would result. He wanted to avoid the use of the pelican.

Joseph Fox, in his *"Natural history of the human teeth—describing the*

proper mode of treatment to prevent irregularities of the teeth," published in 1803, was the first to give explicit directions for correcting the irregularities of the teeth and his method of treatment was used for nearly a half a century.

Fox's method of treatment was a great improvement over that of Fanchard and Bourdet. In explanation of its use Fox says, "To remove the form of irregularity, two objects must be accomplished; one, to apply a force which shall act constantly on this irregular tooth and bring it forward, the other, to remove that obstruction with which the under teeth always occasion." The first of these objects may be attained by the application of an instrument adapted to the arch, which being attached to some strong teeth on each side, will furnish a fixed point in front, to which a ligature may be applied and thus by occasionally renewing it, a constant pressure is preserved and the tooth may be drawn forward. The second object, that of removing the resistance of the un-

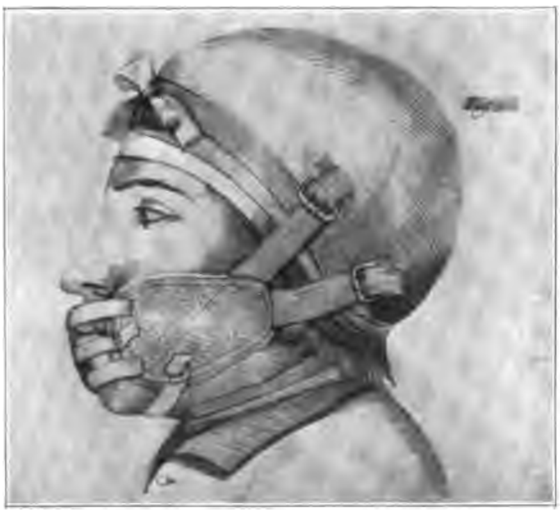


Fig. 2.—Chin-cap devised by Cellier, 1802, though not used for occipital resistance.

der teeth, must be attained by placing some intervening substance between the teeth of the upper and lower jaw, so as to prevent them from completely closing and bringing obstruction to the coming forward of the irregular tooth.

The chin cap was first used by Cellier in 1802 and a year later by Fox, as a occipital mental sling in cases for luxation and not for occipital resistance or anchorage as is generally credited.

As to the causes of these irregularities Fox has the following to say: "The most frequent cause of irregularity is a want of simultaneous action between the increase of the permanent teeth and the decrease of the temporary ones by the absorption of their fangs, most commonly occasioned by the resistance of the nearest temporary teeth; also from the fact that the permanent teeth are too large for the space occupied by the temporary. The growth of more teeth than the natural number frequently occurs and is always the cause of great irregularity of the teeth."

The Irregularity of the Teeth.—"During the shedding of the teeth there

are several circumstances which prevent the permanent teeth from acquiring a regular position, and often give rise to very great irregularity in their arrangement.

"The most frequent cause is a want of simultaneous action between the increase of the permanent teeth, and the decrease of the temporary ones, by the absorption of their fangs. It rarely happens that so much of the fang of a temporary tooth is absorbed as to permit its removal by the efforts of the child, before the permanent tooth is ready to pass through; on which account the new tooth takes an improper direction, and generally comes through on the inside.

"Cases are very frequent in which scarcely any absorption of the fangs of the temporary teeth had taken place previous to the appearance of several of

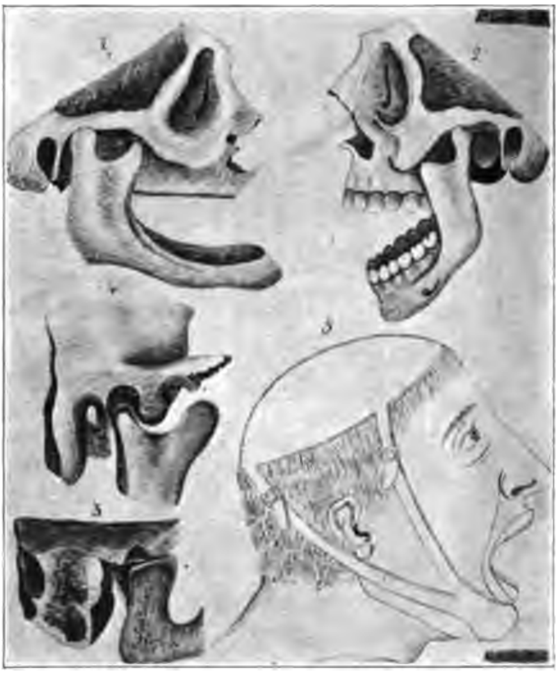


Fig. 3.—Chin-cap devised by Fox, 1803, used as an occipital mental sling for luxation. From original drawings, Surgeon-General's Library, Washington, D. C.

the permanent teeth; and it often happens, that upon the removal of the shedding teeth to give room for the permanent ones, no absorption of the fangs of the temporary teeth has taken place.

"Irregularity of the permanent teeth is most commonly occasioned by the resistance made by the nearest temporary teeth; this always is the case if the temporary teeth are small and close-set, for as the permanent incisors are much larger than the temporary, they require more room; but if the space left by the shedding of the temporary teeth is too small for the regular position of the permanent, they are exposed to the pressure of the next tooth, and hence are frequently turned out of their right direction.

"Another cause of the irregularity of the teeth arises from the permanent teeth being too large for the space occupied by the temporary ones; those parts

of the jaws not being sufficiently extended to permit a regular position of the new teeth—in this case the irregularity is considerable, and occasions great deformity in the appearance of the mouth. The incisors and cuspidati being much larger than those of the child, require more room, for want of which they are turned out of their proper positions. The central incisors overlap each other —the lateral incisors either placed obliquely with their edges turned forwards, or they are pushed back, and stand between and behind the central incisors and the cuspidati; the cuspidati are projected, occasioning the lip to stand out with considerable prominence, and the bicuspids are placed very irregularly."

Varieties of Irregularities of the Teeth.—"I will now describe the different states of irregularity and to avoid confusion take each jaw separately.

"In the under jaw, when the growth of the permanent central incisors has exceeded the absorption of the temporary ones, they grow up immediately behind them, in a direction towards the tongue. These two new teeth are generally so broad as nearly to cover the inner surface of the four temporary incisors. It will therefore be necessary, in order to obtain room for these teeth, that the four temporary incisors be extracted. The new teeth will then gradually come forward, in which they will naturally be assisted by the pressure of the tongue of the child, and may be occasionally helped by the finger of the parent or the nurse.

"When the permanent central incisors have completely grown up, they occupy fully two-thirds of the space which contained the four temporary incisors; therefore when the permanent lateral incisors appear, they are placed partly behind the centrals and the temporary cuspidati; or they grow up with one corner turned forwards and the other pointing backwards. In either of these cases the temporary cuspidati must be removed to give room.

"The four permanent incisors take up nearly the whole of the space of the temporary incisors and cuspidati. The permanent cuspidati are large teeth, and when they have not sufficient room, they occasion very great irregularity. Sometimes they come through on the side, but most commonly they cut the gum on the outside, and project very much out of the circular line from the temporary incisors to the temporary molars. In this case the necessity of the removal of the first temporary molars is obvious.

"It is not very common that the bicuspids of the lower jaw are irregular, because the temporary molars are generally removed before they appear, but when this is not the case, they always come through the gums on the inside, pointing towards the tongue, in which case the temporary molars must be removed, that the bicuspids may rise into their proper situations.

"In the upper jaw the permanent central incisors sometimes pass through the gums behind the temporary ones; when this happens, the four temporary incisors must be extracted, and frequent pressure by the thumb should be applied to the new teeth, in order to bring them forward as soon as possible, and prevent one of the cases of irregularity most difficult to be remedied.

"When the temporary central incisors have come out, the space is generally too narrow for the permanent ones and hence they are pressed into some shape of distortion. Their edges do not assume the regular curve, but stand

obliquely, or even sometimes one before the other. Cases of this kind require the removal of the temporary lateral incisors.

"The permanent central incisors are very broad; they occupy the greater part of the space of the four temporary ones and leave scarcely any room for the permanent lateral incisors; on which account these latter teeth must grow very irregularly; they generally pass through behind, being forced considerably backwards by the resistance of the central incisors and the temporary cuspidati. Sometimes they pass through edgeways, and now and then they project forwards. In any of these cases the removal of the temporary cuspidati is absolutely necessary, and unless the operation be timely performed, the irregularity is with difficulty remedied.

"The greatest deformity is generally occasioned by the want of room for the lateral incisors and the cuspidati, and when too long neglected usually becomes permanent.

"In almost all the cases of irregularity which occur in the under jaw, nothing more is necessary after the removal of the obstructing tooth, than to apply the frequent pressure of the finger, in such a manner as to direct the irregular tooth into its proper place. It will assist the natural tendency of the teeth to form a regular circle, and to take up as large a space as possible, but in the upper jaw, when the irregularity has been suffered to remain for any length of time, it cannot be obviated without having recourse to other assistance.

"Irregularity is often occasioned by the teeth being much too large for the space allotted them, and then it will be necessary to remove one or more of the permanent teeth.

"It has been the common practice to admit the cuspidati to grow down to a certain length, and then to extract them. This operation certainly removed the deformity of projecting teeth, but it destroys the symmetry of the mouth, and takes away two teeth of great importance. The cuspidati are exceedingly strong; they form the support of the front of the mouth, and in the advanced periods of life, to those persons who have the misfortune to lose the incisors, they furnish an excellent means of fixing artificial teeth.

"The first permanent molars often become carious soon after they appear; when this is the case, and the other teeth have not sufficient room, considerable advantage always attends their extraction. Their removal permits the bicuspids to fall back, and gives way for the regular position of the cuspidati.

"The removal of these teeth when decayed ought always to be recommended, although they may not occasion pain, or there be no irregularity in the front teeth, diseased teeth always affect others, and therefore ought never to remain in the mouths of children.

"If they be extracted before the second permanent molars appear, in a short time they will not be missed, because the bicuspids will go back, and the second and third molars will come forward, so that no space will be left.

"When the permanent incisors of the upper jaw have cut the gum behind the temporary teeth, and have been suffered to remain until considerably advanced in growth, they always stand so much inwards, that when the mouth is shut, the incisors of the under jaw stand before them, which is always an obstacle to their acquiring regularity, and occasions a great deformity.

"There are four states of this kind of irregularity. The first when one central incisor is turned in, and the under teeth come before it, whilst the other central incisor keeps its proper place standing before the under teeth.

"The second is, when both the central incisors are turned in, and go behind the under teeth; but the lateral incisors stand out before the under teeth.

"The third variety is, when the central incisors are placed properly, but the lateral incisors stand very much in; and when the mouth is shut, the under teeth project before them and keep them backwards.

"The fourth is, when all the incisors of the upper jaw are turned, and those of the under jaw shut before them. This is sometimes occasioned by too

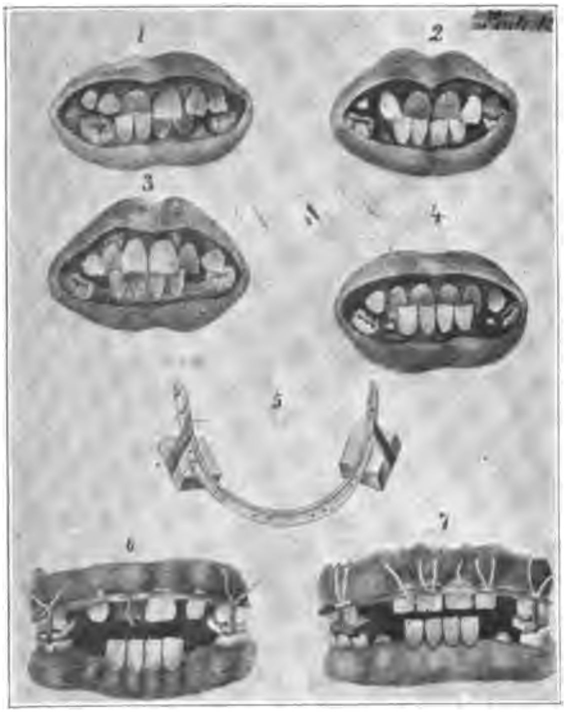


Fig. 4.—Appliance devised by Fox, for correcting irregularities of the teeth. Original drawings, Surgeon-General's Library, Washington, D. C.

great a length of the under jaw, in consequence of which it projects considerably more forward than the upper jaw. But the majority of such cases originate entirely from neglect, and may be completely remedied by early assistance.

"To remove the kind of irregularity above mentioned, two objects must be accomplished; one, to apply a force which shall act constantly upon the irregular tooth, and bring it forward; the other, to remove the obstruction which the under teeth by coming before the upper always occasioned.

"The first of these objects may be attained by the application of an instrument adapted to the arch of the mouth, which being attached to some strong teeth on each side, will furnish a fixed point in front, to which a ligature previously fastened on the irregular tooth may be applied, and thus, by occasion-

ally renewing it, a constant pressure is preserved, and the tooth may be drawn forward.

"The second object, that of removing the resistance of the under teeth, must be attained by placing some intervening substance between the teeth of the upper and under jaws, so as to prevent them from completely closing, and be an obstruction to the coming forward of the irregular tooth.

"The instrument may be made of gold or silver, it should be so strong as not easily to bend; if about a sixteenth of an inch in breadth, and of proportionate thickness, it will be sufficiently firm. The bar of gold must be bent to the form of the mouth, and should be long enough to reach to the temporary molars, which are the teeth to which it is to be tied. Holes are to be drilled in at those places where ligatures are required, which will be on the parts opposite to the teeth designed to be the fixed points, and also at the parts opposite to the place where the irregular tooth or teeth are situated then to the bar a small square piece of ivory is to be connected, by means of a little piece of gold, which may be fastened to the ivory and the bar by two rivets. This piece of ivory passes under the grinding surfaces of the upper teeth, is kept there fixed, and prevents the teeth from closing and consequently takes off all obstruction in front.

"The bar is to be attached by a strong silk ligature to the teeth at all sides so that if possible it may remain tight as long as it is required; a ligature is then to be tied around the irregular tooth, and the ends, being brought through the holes in the bar, are to be tied in a firm knot. In two or three days this ligature must be removed and a new one applied; the tooth will soon be perceived to move. A fresh ligature must be used every three or four days, in order to keep up a constant pressure, sufficiently powerful to bring the tooth into a line with the others.

"The same mode of treatment is to be observed whether there be one, two, or three teeth growing in a similar manner. The teeth are usually brought forward in about a month or five weeks, and as soon as they are so much advanced as to allow the under teeth to pass on the inside, the piece of ivory may be removed, and the bar only be retained for a few days, until the teeth are perfectly firm, which will prevent the accident of the teeth again receding.

"In cases where the irregularity has been suffered to continue too long, no success can be expected to follow attempts to remove it; we must content ourselves in the treatment of these cases in adults, with taking away the most irregular teeth, and thus, as much as possible, lessen the deformity."

J. R. Duval (1805), a prolific writer, called attention to the causes of irregularities of the teeth and their treatment as early as 1805. "The conformation of the face almost always determines the order of the teeth, when it is flat and square, the jaw presents the contour almost circular while the teeth are planted with more regularity; on the contrary, when the face is straight and projecting in the middle as if the head had been squeezed at its sides, the jaw presents the form of the extremity of an oval and does not offer sufficient room for the arrangement of the teeth, hence we have mouths which seem to have a double row of teeth, if the dentist has not early watched the cutting of the in-

cisors, or if he has not sacrificed secondary incisors, canine or grinders . . . it is usually called a gag-tooth, or wolves tooth."

His method and reasons for extraction were as follows: "Those which are most frequently out of their places are the canine of the upper and lower jaws, the deformity which results from this deviation might promptly determine us to extract them if we were not aware that they are less susceptible of caries than the small grinders which are in contact with them, and therefore, we ought to sacrifice the latter, and preserve the canine, which are more visible when a person laughs or speaks; for although at first they may be far from the place which they ought to occupy, they will arrange themselves more readily when the obstacle is removed, especially if they are often pressed with the finger according to the advice of Celsus, a celebrated physician of the Augustine Age. We should also take away one of the small grinders if it be irregular which is, however, more rare, and less urgent with regard to the appearance."

In the correction of the teeth, Duval cautions against the use of the file, seldom recommending this method of procedure. "Equal prudence should also be used in the employment of gold wire or silk for altering the position of irregular teeth; the irritation, pain and loosening, which it is almost necessary to produce, shows the necessity of caution, as well as in the use of gold bars, and forceps which are sometimes used for the same purpose, art proposes the means, the dentist should weigh well the advantage and disadvantages, the success at the time speaks much in their favor, but how many have to complain (though too late it is true) of having paid dearly for a few weeks of beauty."

Duval was perhaps the first to note the importance of the relation of upper and lower jaws. "It is not sufficient that the teeth are properly arranged, by the side of each other, those of the upper jaw, have a special connection with those of the lower, the least deviation from which diminishes the beauty of the appearance, frequently renders their functions laborious, and may often tend to their mutual destruction. Thus the superior incisors pass over the inferior and imitate in their action the cutting of a pair of scissors; in general the more parallel they are when brought into contact, the more they communicate to the face the character of beauty.

"The more the incisors recede from that parallel line, the more they diminish the graces of the visage and of the mouth; we sometimes see a projecting chin, and the teeth both of the upper and lower jaw are turned inwards, towards the tongue, and we sometimes find a white singularly disfigured, by the teeth projecting outwards, which is supposed to constitute the beauty of the mouth of a negro. Against these two deformities which proceed from the conformation of the jaws, art is not able to offer any sufficient resources.

"Sometimes the incisors of the lower jaw pass before those of the upper. In this deformity, we must not expect that art will be equally effective, especially after the teeth are renewed and the eight large grinders are cut, there exists between the corresponding surfaces of the teeth of the two jaws, a disposition which does not easily change or if such change should be effected disagreeable consequences may ensue; the most proper time is that when there are no more than eight secondary incisors.

"If art can be of any service in either of these cases, it must consist in facilitating the diminution of the dental arch by the extraction of an incisor; but can we warrant the success of this operation and at what age, and upon which tooth ought it to be performed? Let us use caution here, and rather content ourselves by rectifying certain deviated incisors, which gives the appearance of a projecting chin."

In the correction of these deformities Duval recommends the method of Fox's and the use of the inclined planes. He also speaks of a guttered plate, which has been in use for over twenty years, but fails to describe or illustrate same. Delabarre describes it "as a sort of small inclined die, which, placed over the tooth that has deviated to the exterior, is disposed of in such a way, as to strike, at every occlusion of the mouth, the teeth that meet it." Talma later mentions the same appliance describing it as "a gold or platina plate, with which the lower circle is cased, and which is fashioned in the shape of an inverted groove or gutter and fastened on either side to the molar teeth. Here is the beginning of our present method of anchorage."

M. Miel (1808) first directed attention to changes produced by the teeth of the lower border of the inferior maxilla. He showed that the lower border of the inferior maxillary bone is slightly arched upwards, and backwards, in the child and older person, but that it is perfectly horizontal in the adult.

The fact of the equality of length of the anterior portion of the dental arch, before and after the shedding of the teeth, was effectively proved by Hunter and M. Miel; although its invariability, during all the process of second dentition was not made out by these authors. This, however, has been perfectly established by M. Oudet, in a paper which he read in 1824.

"M. Miel, who gave considerable attention to this subject, and who warmly defended the opinion of Hunter, adds: 'The appearance of the second teeth is but a substitution of those which are longer and more capable of effecting the uses of a more vigorous age; their total volume is the same as that of the temporary teeth, the only difference is in their respective size.' Another circumstance, upon which M. Miel lays great stress with much reason, is that the teeth of those persons in whom the second dentition is premature, are not placed regularly in the arch, but are pressed up against each other."

Catalan (1808) illustrated and described the principle of the inclined plane for moving interlocked upper incisors into lines as then used, although used prior to this time and mentioned by other authors,—Hunter and Duval. It was made of a long narrow band of gold or silver passing along the labial surface of the lower, metal clasps or projections were soldered to the band and bent inward at points opposite the malposed tooth of the upper so that in occluding, this tooth would be forced outward. These metal inclines rested on the cutting edge of the lower incisors in order to resist the strain.

This appliance was used to a great extent for many years, greatly improved and claimed by a number of authors as originating with them, although described prior to Catalan's time, many mentioning the use of same.

John Fuller (1810) attributes irregularity to too long persistence of temporary teeth; he also says that the upper jaw is too small for the permanent teeth, which fact often occasions irregularity. "Some children have the habit

of projecting the under jaw forward, and, of course, shutting one or more of the under front teeth beyond the upper, which soon becomes permanent."

Joseph Murphy (1811) in *"A Natural History of the Human Teeth,"* speaks of irregularities due chiefly to the first teeth not having been shed in time, supernumeraries and another cause. Murphy, as well as all his predecessors and those that followed him devoted considerable discussion to the "projecting chin" and advocates the extraction of teeth in the correction of same. In those cases with protruding anterior teeth he made use of a bow or spring of gold wire, with flat hooks fixed upon the incisors and the ends of the spring drawn down and tied to the molars at each side.

He also advocated the use of wood, flattened and used as a lever.

"It is now pretty generally known that children's teeth may be regulated

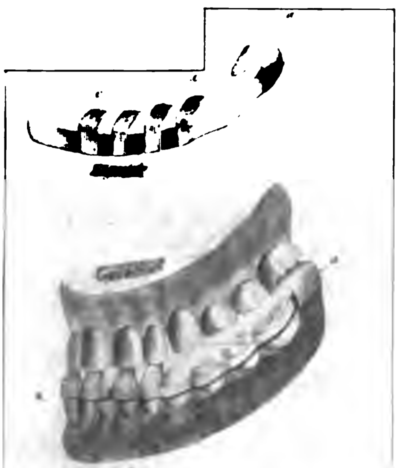


Fig. 5.—Appliance used in time of Catalan and credited to him, although in use prior to his time.

Fig. 6.—Appliance used by Joseph Murphy to correct deformity of the teeth. The four figures illustrate the various positions of the teeth and jaws as described by Fox.

in their growth, so as to prevent irregularities; but it is of the greatest importance that the regularity of children's teeth may be entrusted to proper and skillful hands; incurable deformities and loss of teeth are too often the consequence of improper treatment.

"The influence of the teeth, in giving form and expression to the human face, is much more considerable than is generally supposed.

"The symmetry and beauty of the oval of the countenance depend entirely upon the form of the mouth and chin; the form of the latter is determined by the shape of the jaw bones, and the regularity of the teeth; both of which may be greatly influenced by the mechanical pressure.

"The annexed plate represents a few cases drawn from nature, which were regulated and reduced to symmetry.

"The most remarkable effects produced on the countenance by irregular positions of the teeth, are the projecting chin, and the prominency of the two front teeth of the upper jaw, commonly called the rabbit mouth. There are many other deformities occasioned by irregularities of the teeth, but of less importance than these. They are generally caused by the first teeth not being shed in time to make room for the second; the latter consequently take irregular positions; and when suffered to remain in this order, until the teeth of

Fig. 7.—Title page, "Treatise on the Management of the Teeth," Benjamin James, 1814. One of the few illustrated title pages of dental books.

the upper, and those of the under jaw have come into irregular contact with each other, the deformity becomes established.

"The projecting chin is frequently a consequence of the causal irregularity."

Benjamin James (1814) wrote in a *"Treatise on the Management of the Human Teeth."* "With proper attention paid to the removal of the first set of teeth, the regularity of the second may be anticipated. . . . The jaw of a person very young is so soft and yielding that a tooth taken out at a considerable distance from a deranged tooth makes room for it, the teeth on each side of the one extracted crowding in to fill up the vacancy. But when the jaw has become more hard and unyielding, we can make room for the deranged teeth only by drawing those in immediate contact with them. Then, by gentle compression of the finger applied daily for several weeks to the deranged tooth, we see it come into its proper place as effectually as from ligatures, spring, or violence.

"The sides of the upper teeth touch only at that point which is most distant from the gum, for this reason noxious accumulations between the upper teeth cannot be so easily removed as between the lower teeth. It is therefore, in the power of the file to destroy the greater aptness of the upper teeth to decay." We thus note the beginning of preventive treatment for decay.

Charles Bew (1819). From the time of Hunter until Bew little attention was paid to the occlusion of the teeth and the importance of maintaining same. Bew, in 1819, called particular attention to this most important subject of our work as follows: "By the arrangement here offered it will be seen that nature as if to guard her work from injury by close contact had so planned the situation of the teeth, that no single tooth should in fact press solely upon the other, but in the powerful triangular ratio of one to two, and even in this, the power appears to be admirably settled for the general economy, by being confined to the sides.

"For an examination of the central incisors if the information be perfect the impression of the teeth is made by the overhanging of the upper jaw, passing in a slanting direction upon the notched surfaces of the under incisors, the cuspidati performing the same action. The bicuspids occilauti the preparation of food for the stomach by the addition of a double lateral action, as the *Mitre Like Forms* of the upper bicuspids are made to sink into the corresponding cavities of the lower bicuspids.

"The good effects resulting from attention to the teeth in the earliest stages, even to lengthened existence, is so abundant in advantage as to require agreement for the enforcing of the necessity.

"Enough has been said and seen of the propriety of proper attention being paid to the primary teeth for the better arrangement of the permanent set.

"If the permanent teeth are arched in their progress they will arrange in the most perfect order when many of the attendant evils which I have described in this work, will be happily obviated. As it is often found much easier to prevent than cure a disease, so it is more advisable to avoid deformity, by subjecting the child to the trifling pain and gradual loss of one or two teeth in a month, during dentition, than to reserve them by dozens, for the *coup de main* of the dentist: who is not only often reluctantly compelled to leave the habitation for a time tenantless, but to sting the thoughtless parents, by the promulgation of an evil out of his power to eradicate."

Delabarre in his work on *"Second Dentition"* (1819), devoted considerable space to the subject. He described for the first time in 1815 (*Odontologische Beobachtugen,* Paris) the use of metallic caps, or crowns, for the rotation of teeth; until then the practice was to use a notched hickory, by the use of silk ligatures passed around the tooth and tied, thus turning the tooth, applying same daily, although Fanchard described how this was accomplished in one sitting. The appliance consisted of a metal box or crown, molded to the exact form of the tooth, with a threaded tube soldered end-wise to the crown. A piece of gold wire bent nearly at right angles and threaded was screwed into this tube; the other end contained a loop. The spring of the wire on being bent down and tied to the teeth, rotated the tooth.

For the purpose of keeping the antagonizing teeth apart he devised the

first wire crib, a device which later proved of great use as an anchorage. This was later modified by Schange and others. It consisted of six pieces of gold wire bent and soldered together, forced over the teeth, and closely fitting the teeth at the gingival border.

To the writings of Delabarre we are probably more greatly indebted than to any of his contemporaries; while many of his ideas were wrong, a great many were correct. I therefore believe it wise to quote a part of his work in this paper, first, to show the knowledge he had of the subject, and second, as a valuable lesson to all.

"The authors of nosology and physiology devote even some lines to them

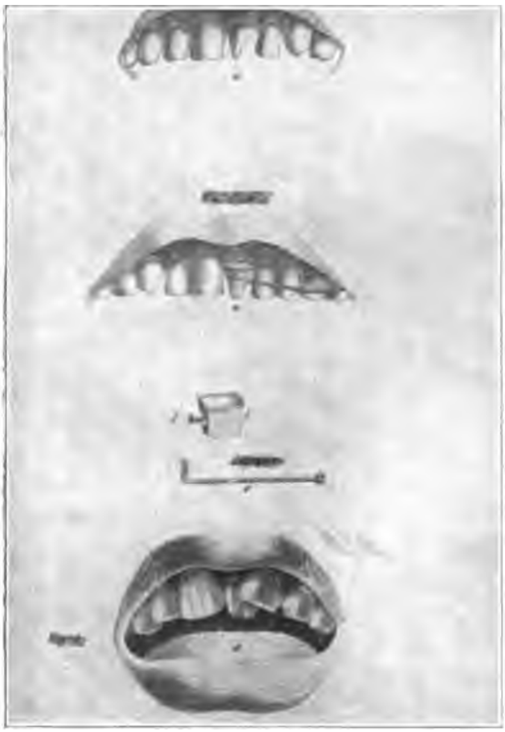


Fig. 8.—Appliance used by Delabarre to rotate anterior teeth showing, perhaps, the first crown, and tube (threaded) to be used in orthodontia.

Fig. 9.—First wire crib, Delabarre.

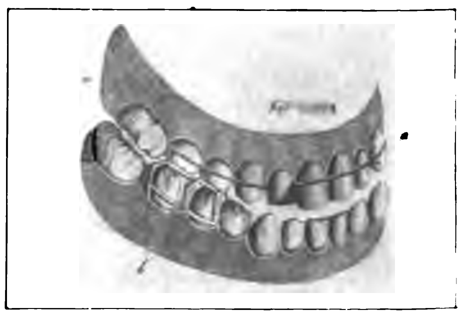


Fig. 10.—Showing crib adjusted to the teeth.

but they appear to mention them only to complete the plan of their works, and thus they have treated them only very superficially. Many, indeed, though freely confessing the great want of knowledge, of the expansion, growth and disease of the teeth, are nevertheless, by reason of their numerous engagements, unable to devote themselves to their study.

"Formerly, these bones were regarded, indeed, as mere ornaments of the face, and consequently their preservation was rather the province of the perfumer than the regular physician.

"Men of approved medical knowledge, however, have had first dentition under their inspection, but it is not thus with the branch we are now consider-

ing. This has been left to the observation and sagacity of the dentists possessing not the requisite physiological knowledge.

"The laws that govern the expansion, growth, and arrangement of the teeth are properly the patrimony of the physician, who should understand them in order to direct the dentist whenever (which unfortunately is too frequently the case) he is not furnished with sufficient information on all the duties of his profession.

"It is very desirable that there should be a class of physicians, who would give their attention to the practice for the diseases of the mouth; this is the only means of preventing so interesting a part of our art from falling into the hands of mere practitioners, or from becoming the prey of the vilest charlatans. Such persons cannot practice any part of surgery without detriment to society.

"These principles may be applied to the treatment of second dentition; it is much easier to extract teeth, than to determine whether it is absolutely necessary. The extraction of a tooth requires nothing more, on the part of the practitioner, than a certain degree of facility in the use of instruments that are usually employed in this operation; whilst the knowledge necessary to appreciate the consequences can only be acquired by time and study.

"Although the utility of a work in which the different opinions of these authors should be impartially discussed, has, for many years, appeared incontestible, and although I have collected many notes on this subject, yet believing the task was too great for me, I have for a long time hesitated to arrange them. Nevertheless, the necessity of instructing our young practitioners on the choice of means to regulate second dentition, has triumphed over the repugnance I have felt to attach received opinions, and a mode of treatment sanctioned by time and supported by the most celebrated authors.

"In order, therefore, to contend with success against so great authorities I must be read without prejudice, and by those who will be disposed to examine the physiological facts that I oppose those theories which I think proper to controvert. I ought, accordingly, before presenting the natural method for aiding the arrangement of the dental arch at the time of moulding the primitive or temporary teeth, to review the phenomena displayed in the formation of the second teeth, as well as in the progressive enlargement of the jaw, until the termination of the second dentition.

"*Natural Method of Directing the Arrangement of the Adult Teeth.*—Since the progressive eruption of each series of teeth is one of the laws ordained by the Creator, why have so many authors on dentistry endeavored, by the spirit of the systems, to follow a different course? Why do we find so many dentes excerti among children of the wealthy class whose dentition meets with the more attention, while they are of so rare occurrence among the indigent that have very little recourse to professional aid, but rely upon the goodness of nature. Is not a part of those vicious dentitions, which we so frequently meet with in society, owing to the unsound system adopted by dentists? Is not their system founded rather on faulty reasoning than on the study of the anatomy and physiology of the mouth and jaws? These are questions which I shall endeavor to resolve, while giving a general view of the system adopted and recommended by men whose works are in very great repute.

"It is, therefore, indispensable to examine dentition under its different aspects, in order to aid nature only when she of herself, is unable to accomplish her task. It is, then, only that the physician is neither to be a slave of systems, prejudices, or routines, or opposed to the operations of changes that he cannot foresee; the end to which the surgeon aims; it is the proper adjustment of the adult teeth; but can he effect this only by the evulsion of the temporaries?

"Have authors on dental surgery taken cognizance of the constant and natural imbrication of the teeth during their formation? Have they ascertained, that as the teeth of replacement are below the gums, there cannot be any contact between them and the temporaries, and have they from this understood that these last cannot prevent the eruption of the other, except at the moment in which this contact becomes possible? Have they observed that ingenious means employed by nature to destroy the teeth, whose presence ceases to be useful? It appears to me that none of them have examined these various questions; for they then would have seen, that their system is essentially vicious; they would have perceived that the more the temporary teeth are removed the more the jaws contract, instead of their being by this means, necessarily assisted, and as it were forced to increase.

"The natural method, that I am about to explain, differs essentially from this; for, according to it, the presence of the temporary teeth is considered necessary, until a determined epoch, and here all the care of the surgeon only tends to favor the increase of the maxillary circle; it never shows, that, whatever be the width of the replacing teeth, and even if their number be greater than it usually is, they will always have a tendency to be well arranged provided the maxillary arc is proportionally expanded, whether by natural or artificial means.

"But it is very essential to know that there are in certain individuals, predispositions that will prevent or retard the development of the maxillary bones; and which will, whatever be the system we follow, and how small so ever be the teeth, deprive us of the satisfaction of seeing them well arranged. Consequently the physician should ascertain, by inspecting the subject, if second dentition can be performed with ease, which he may presume may be the cause whenever he meets with facts below enumerated.

"First. When a child of about seven years, on whom the temporary teeth are loosened, is of good constitution—has not had any severe disease in the first three or four months of its life—and all its members are well developed.

"Second. When the jaws assume a form rather circular than elliptical—the primitive teeth present a good arrangement—the palate does not describe the triangular arc, but offers a flattened and regular concavity; the inferior jaw does not project beyond the superior.

"Third. When the temporary teeth are rather large than small, and are rather separated from each other than crowded together.

"Fourth. When the teeth, primitively crowded, after a time separated; which in effect may be observed from the age of four to five years old, and is a certain indication that the jaw assumes its increase.

"Fifth. When this separation is effected with harmony and simultaneously on both jaws; for, if it only occurs on one, and especially if on the inferior jaw, we should find that the opposive denture would be prominent.

"Sixth. When, between five and six years, we see four permanent molars appearing, in whose dimensions there is nothing extraordinary for, in the contrary case, we should presume that all those that are to come after them, will share this excess of size.

"Seventh. When between the ages of seven and eight years, the temporary incisors gradually loosen, and on putting the finger within the mouth no jutting points are perceived, because then it is presumable that the teeth of replacement are forced below the temporary roots and will determine their complete absorption.

"Eighth. When the teeth are ready to be moulded, are found pushed before or raised by those that are to be replaced by them, and which immediately show themselves from below.

"Ninth. When all the temporary have been maintained, each in its place, and no disease has occasioned its premature evulsion or loss.

"Tenth. When the natural loosening and moulding of the temporary teeth take place in the order and at the usual epoch for shedding each series of teeth in the human species; an order and epoch which we have before noticed.

"The physician should be careful to ascertain whether the jaws of the infant have any hereditary tendency to assume particular forms, for we sometimes as I have said before, meet with a family, all of whose dentures describe exactly the same arc; which contributes not a little to establish a resemblance in their physiognomies. It is also proper that he should know how to distinguish the three ordinary positions of the inferior maxillary bones relative to those of the superior.

"Thus, 1st, when the chin is short and the superior jaw well arched, the series of the six superior teeth passes before the six inferior, somewhat like the blades of a scissor.

"Second. When the chin is a little longer, and the teeth are short, the two dentures fall plumb upon each other without crossing.

"Third. If the chin is very long and the superior maxillary be but little depressed in its anterior arc, the six inferior teeth pass before the superior, like that which may be observed on dogs and some kinds of apes.

"Finally, there is a species of torsion of one or both of the jaws, which causes the superior anterior temporaries on one side of the median line, to fall outside of the inferiors, according to the right disposition, whilst the similar teeth on the other side of the same line drop within the inferiors; if in such a case the difficulty is not obviated it is probable that there will be a similar disposition in second dentition.

"After having completed this preliminary examination, the physician should make his prognosis, and inform the parents of what peculiarity the denture of the child will present, in order that the irregularity that may result, and which he cannot prevent, may not be imputed to him.

"Though in certain embarrassing circumstances where there was a vice of conformation, I thought advisable to make some modifications in the method that I am now describing, still I believe that it should seldom be varied.

"If it happens that a canine precede the bicuspids, I, in consequence, am

led to extract them, whose looseness turn me from what I, otherwise, would have done.

"According to the method I have just described, it is only necessary that the surgeon-dentist, should, for the most part, be a tranquil observer of the shedding of the teeth; for the temporaries frequently fall out of themselves, and when he thinks that they ought to aid nature we see that he should extract only one tooth at a time, whose place may be supplied by another; so that in following this course, he will not notch the denture of a subject, when any of the adult have failed, as they frequently do to be developed.

"Thus, this method is founded on the principle that each of all the temporaries, before they are replaced by an equal number of adult teeth, does not form any true obstacle, except at the moment in which that which is to succeed it begins to appear, and instead of the neighboring teeth being considered as opposing the arrangement of the one that arrives and endeavors to intercalate itself between the others, they should be regarded as affording solid parieties against which this tooth may be supported, forcing thus the jaw to be increased; but if this effort does not follow, I think it right to employ mechanical force to produce it, especially if the child has been in good season deprived of some of the temporary teeth, or even if we perceive that those of replacement, being too much pressed by their neighbors whose time of moulding has not yet come, threaten to preserve that vicious obliquity which they affect. Thus, in a very great number of cases, I have obtained this enlargement, with the aid of a thread, which having been twisted around the temporary and adult teeth, becoming swelled by the humidity of the mouth soon brings to its proper place of the tooth that appears to be about to take the wrong direction. This is a simple process, and when the dentist has once or twice placed the ligature in the presence of an intelligent person, he may entrust to him the task of its removal. At other times, small wedges of wood have been employed with like success. In general the traction should be gradual so as to give the maxillary bones time to yield to its impulses.

"We must not lose sight of this physiological principle, that, by drawing a tooth away from one side, the alveolus is enlarged, and a slight swelling developed that occasions a supportable disquietude, which degenerates into pain, if the sensibility of the parts has not been treated with skill; it is therefore, necessary to allow nutrition sufficient time to effect the absorption of the alveolus on the side to which the tooth is to be carried; whilst the opposite wall will approach it, and the osseous juices supplied from exhalation by filling up the vacuum render a deviation impossible.

"The deviations of teeth of the ordinary size are very common to feeble children, on whom the absorption of the temporary roots is generally effected with difficulty, and the increase of whose maxillary circle is very backward.

"Deviations caused by the excessive size of the teeth, unaccompanied by a vice in the conformation of the jaws, are likewise of frequent occurrence and require different operations, according to the different cases.

"When each tooth is only a little too large, we should, before employing the traction of threads, file between the several teeth, we may by this means obtain from the whole, the space of a third, or a fourth of a tooth than cut the

rest too much, when the size of these bones appears to be extraordinary, and especially if there exists the least defect in the conformation of the jaw. When the fault is very decided, I find it more prudent to remove the teeth out of the row than to attempt to bring them within the circle. As the rest, we should never be in haste to make their evulsions, for the jaw sometimes increases when we least expect it; so that instead of there having been a sacrifice of several, which it was supposed must one day be removed; that of one also has frequently been sufficient; while we are thus temporizing, therefore we are only courting favorable opportunity. I never have had occasion to regret acting in this way, even when I have refused the reiterated requests of the persons that were charged with the children found in this condition.

"It is, consequently, only after having been perfectly satisfied, that the teeth which are badly arranged can never be rectified, that I attempt to remove them, and I usually practice this operation about the age of twelve or thirteen years; for then the anterior arc of the jaw is susceptible of but little increase.

"In other circumstances when one desires to regulate the denture by removing the teeth, he should extract some in preference to others, thus all dentists agree to sacrifice a small lateral or central incisor that is wholly out of the row; the same may be said of the conoids when in a similar situation, unless the bicuspids be diseased; but we should generally prefer to remove one of these, in order to make room for a canine or conoid, that we believe can be brought back with facility.

"When I, from the arrangement, am led to believe that a small gap must result from the indispensable sacrifice of a tooth, I prefer to remove the second bicuspid, to facilitate the placing of the conoid; but then it is necessary to bring back the first bicuspid, by means of a thread that draws it towards the great molar. In this way a void space will be found in the anterior of the mouth.

"The evulsion of the first great molar affected with caries, appears to me to be but little capable of favoring the arrangement of a conoid, though it may be useful in assisting that of a tardy bicuspid. All these cases demand care, and may compromise the reputation that has not decided with sound judgment.

"There are, nevertheless, two exceptions to this sort of general rule, relative to the following cases.

"First. When the jaws of a child, which are still adorned with first dentition, present the defect which causes them somewhat to resemble a shoe.

"Second. When the vicious contraction of the upper jaw is such, that there is no hope that it can be corrected.

"Then my practice is as follows: I remove as soon as they appear, one or two small inferior central incisors of replacement; this operation in some degree arrests the development of the lower jaw, which it was found would be left to project beyond the superior; and as the other teeth gradually shoot up, I draw them towards the median line and there detain them by means of a thread. Though fully convinced of the delicacy of this operation, and the responsibility hanging on my reputation, I have performed it twice and with complete success.

"It will be seen, that in the two cases above cited, I readily sacrificed teeth that had just come up, without waiting until dentition was terminated, for then

the vicious development of the jaw would have been completed, which on the contrary, it is very essential to prevent.

"It has been my good fortune, several times to bring back without sacrificing a single tooth, two conoids that had shot entirely without the circular line, in consequence of the bad management that had been used at the time of the removal of the denture, and which suspended the development of the alveolar circle; but before I commenced these important operations, I was always well assured that there was no defect in the conformation of the jaws, that the teeth were only of the ordinary breadth, and finally, that the subject was not more than eighteen years old. Thus, whatever may be the cause of the deviation of the teeth it is always accompanied by a relative contraction of the alveolar circle; but is it by removing the milk teeth that this will be ever enlarged? And it is well established that we may determine the increase of the jaw, by attracting to it a greater quantity of nutrition; should we hesitate to have recourse to this means?

"Let us, therefore, know how to derive advantage from our physiological knowledge in giving an agreeable contour to the face; but let us not, at the same time, forget that the vices of conformation, to which it has not in time applied its resources, should frequently be respected, that the efforts which we make to correct them may, by disappointing our expectations, be prejudicial to the subject.

" 'Would that the ideas of the beautiful and marvelous did not so much mislead us,' says the judicious Duval, on this subject.

"Still, if the defect of the conformation of the jaw be scarcely sensible, if, moreover, the teeth be rather small than large, and rather separated than crowded, we may then, with good hope of success, act as in cases of simple deviations, caused by a want of development, this is what is more frequently met with in the superior than the inferior jaw.

"From the observations (whence it is clearly shown that the problem to be solved is the increasing of the jaw, when this is not effected by nature herself), we must admit that the sacrifices have recourse to the last resort of extracting the adult teeth only when there is no longer any hope of the increase, destroying or diminishing the defects; and mechanical means, skillfully employed, have been of no effect.

"The irregularity of the teeth presents other facts equally as wonderful; thus, we sometimes meet with a tooth, whose lateral face is turned to the lips; we may also now and then observe one, whose inclined part of lingual face is entirely turned to the side opposite to that where it should be; there are some, too, which shoot up very high in the gum, or very low in the palate.

"How very responsible is that precipitation, which drives some dentists to extract those teeth that have sprung up contrary to nature, since, in preventing one deformity, they frequently occasion another.

"I have seen several subjects, from whom teeth that had come up in this manner were extracted, and who, in consequence were forever after without the right number of teeth. We should thus act, only when the tooth is evidently one of those supernumeraries called intercally teeth.

"Still, I do not advise to leave them in the situation in which they present themselves; the art is not destitute of proper means to correct these defects.

"When one of the six anterior has been completely turned around, we may make it perform a rotary movement on its axis by applying on its crown a sort of die, moulded in the exact form of the tooth, previously isolated from the rest by the aid of a file.

"We cannot without interest see this small machine, which I have always employed with success, whenever a case of this nature has been presented in my practice.

"There are also transpositions of the germs, which cause us now and then to observe a small incisor in the place of a great one, or a canine in the place of a small incisor. Fox has had several of these aberrations engraved; M. Miel recently presented two such instances to the Medical Society of Emulation.

"I have several times seen two teeth placed one before the other, though they both belonged to the same dentition; in a similar case, I found two small incisors, neither of which were within the circle, and one of them was a supernumerary. I was, therefore, very much embarrassed in deciding which of them ought to be sacrificed, for the true supernumerary generally has a shorter root than the other, whilst, on the contrary, its crown is frequently very good.

"I have observed still another variety, which consists in this, that the temporary conoids remain in the row, though the cuspidati and bicuspids of replacement have come up, and are well arranged in their proper order (between the first permanent molars and temporary cuspidati), so that the young person, whose mouth presents this peculiarity, has four very sound cuspidati, (in one jaw), and this without there being any defect in the dental arch. You may readily believe that, in such a case, I advised that not a single tooth should be extracted.

"I will not here attempt to describe all the various machines that have been invented to correct the different deviations of the teeth, but only those that are in use at present, and recommended by men of merit.

"In all these cases, the consequences of which it is prudent to foresee, advice should be given to shorten the teeth that are of more than ordinary length. As to the rest, I cannot too often repeat, that this operation, is not injurious to the teeth on which it is performed, whether with a file or with an excising forceps.

"From what I have just said, which is only the result of rigorous experience, it appears that the file, when prudently used, is not a dangerous instrument to the teeth, its employment is sometimes useless, but never occasioned the loss of these organs.

"If the beautiful arrangement and regularity of the teeth give grace to the physiognomy, they are still of so much more importance to the health, that we cannot too much promote or determine these. When there is a proper symmetry in the two dental circles they fall plumb upon each other, and mastication is performed with ease, but if any tooth is out of the row, and strikes the corresponding one, it renders it painful and loosens it."

We thus note the careful study and excellent advice Delabarre gave to his

fellow practitioners. Were this advice and study followed today how much better off would our little friends be.

Here we also find the first relation of the inferior and superior maxillæ and an attempt at a classification of this subject, the beginning of the system later simplified and modified by Dr. Angle.

The Eastern Association of Angle Graduates

THE Seventh Annual Meeting of the *Eastern Association of Graduates of the Angle School of Orthodontia* was held May 5th and 6th at the Vanderbilt Hotel, New York City. The following very interesting papers were read:

"Diet and the Tooth Brush." By *Dr. A. W. Crosby, New Haven, Conn.* A short digest of some of Pickerill's ideas on the relation of diet to caries and a composite reflection of thoughts expressed on the subject in recent literature.

"The Role of Mouth Infection and Mouth Abnormalities in the Causation of Disease." By *Eugene Lyman Fisk, M.D., Director of Hygiene, Life Extension Institute, New York.*

"The Relation of Mastication to Nasal Breathing." By *Dr. John Kepke, Brooklyn, N. Y.*

"A Study of the Normal Movement of the Permanent Teeth During the Course of Eruption." By *Dr. H. C. Ferris, New York.* Surveys of consecutive models made during the transition period from the deciduous to the permanent denture, showing the relative positions of the permanent teeth, and illustrating the value of the geometrical method in the study of developmental changes.

"Atypical Development in the Light of Correlative Variations." By *George E. Dawson, Ph.D.* Organic evolution reveals a tendency of structural variations to appear in groups. The development of individual forms of life reveals a similar tendency. This is true both of normal and of abnormal variations. Anomalies of the human organism, therefore, should be regarded in the light of this law of group-variation. The corrective treatment of such anomalies should take into account the entire complex of structures and functions with which the anomalies are correlated. This involves, in reality, the entire organism, but it affects more immediately the closely related structures.

"Case Histories which Illustrate the Integrative Action of the Nervous System." By *Dr. J. V. Mershon, Philadelphia, Pa.*

"Dynamical Factors Involved in the Etiology of Malocclusion." By *Dr. J. G. Lane, Philadelphia, Pa.* An analytical study, from the dynamical point of view of the forces directly responsible for the different types of malocclusion, in contradistinction to the tendency of many writers upon Etiology to consider conditions so remote as to be far beyond the operative field of orthodontia.

"The Development and Anomalies of the Maxillæ from the Standpoint of Biology." By *Dr. E. A. Shuman, Springfield, Mass.*

The following clinics were given: *Dr. E. Santley Butler,* "A Lock Appliance for the Treatment of Deciduous or Mixed Dentures;" *Dr. J. H. Worthen,* "Lingual Attachment for Simple Expansion," "Precision .030 Marker," "Instantaneous Clamp for Jig;" *Dr. W. S. Watson,* "Record Keeping," "Photography;" *Dr. H. A. Pullen; Dr. H. K. Hatfield.*

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID McCOY, D.D.S., EDITOR,
LOS ANGELES, CALIF.

THE INTERPRETATION OF DENTAL AND ORAL RADIOGRAPHS

BY JAMES D. McCOY, D.D.S., LOS ANGELES, CALIF.

Professor of Orthodontia and Radiography, College of Dentistry, University of Southern California, Los Angeles, Calif.

THE ability to correctly interpret dental and oral radiographs is an accomplishment which every dentist should possess. In fact, it should be viewed not only in the light of an accomplishment, but as a requisite of modern dentistry. It is to be acquired by practical experience which must have for its foundation, *first, a thorough knowledge of the anatomy of the parts involved; second, a familiarity with the appearance in the radiograph of the dental and oral structures under normal conditions; and, third, a knowledge of the pathological conditions which may develop in these structures, and the character of the anatomical changes which they bring about.*

We should keep in mind the fact that radiographs are shadow pictures, and that the effect produced by the x-ray upon the photographic plate is but a shadowgraphic representation of the tissues through which the rays have passed. As this ray penetrates all matter in inverse ratio to its mass or density, the shadow picture which is left upon the photographic plate is simply a record of the varying density of the tissues through which the rays have penetrated.

The x-ray is particularly applicable to the dental and oral structures, owing to the fact that *these structures differ sufficiently in degree of density to permit of their appearing in a characteristic manner upon the photographic plate.* For instance, it will be noted upon the examination of a dental radiograph, that metallic fillings, if they are present, appear as white masses, and root fillings as somewhat less white lines. The enamel and dentin are next in density, while root canals show plainly as dark channels in the dentin, and the alveolar process and maxillæ show their fine uniform cancellous structure in various degrees of density depending upon their thickness.

Because the structures within the field of our specialty have *a characteristic appearance under normal conditions, any alterations or change in these structures is at once evident upon the plate,* thus affording us a means of studying *intra vitam* the gross pathology of the structures of the oral cavity.

Fig. 1.—This radiograph shows an impacted upper third molar. The outline of the antrum is also plainly visible above the molars and bicuspids.

Fig. 2.—A cuspid tooth lying against the anterior wall of the antrum. It will be noted that the cuspid is inverted in its position.

THE EXAMINATIONS OF RADIOGRAPHS.

Dentists often underestimate the value of radiographs because their opinion is based upon their appearance either in halftone engravings or after their transference upon lantern slides. As such they should never be judged, as much of their diagnostic value is lost when reduced to this state.

Fig. 3.—A supernumerary second bicuspid. Upon the extraction of the second bicuspid in place at the time the radiograph was made, the "supernumerary" erupted, and was found to be typical in size and form.

Fig. 4.—A radiograph to determine the state of dentition of the right side in the mouth of a child eleven years old. The developing second molars are shown, likewise the upper second bicuspid, cuspid, and the lower first bicuspid about to erupt. It will be noted that the lower second deciduous molar has no successor, nor is there an upper first bicuspid present in the jaw.

The original negative itself should be examined carefully and in a proper light. This is best accomplished by the use of an "illuminating" box or cabinet. Such a cabinet should contain several electric lamps, and the current entering these lamps should be controlled by a rheostat, or some other means, by which the intensity of the light may be changed at the will of the operator.

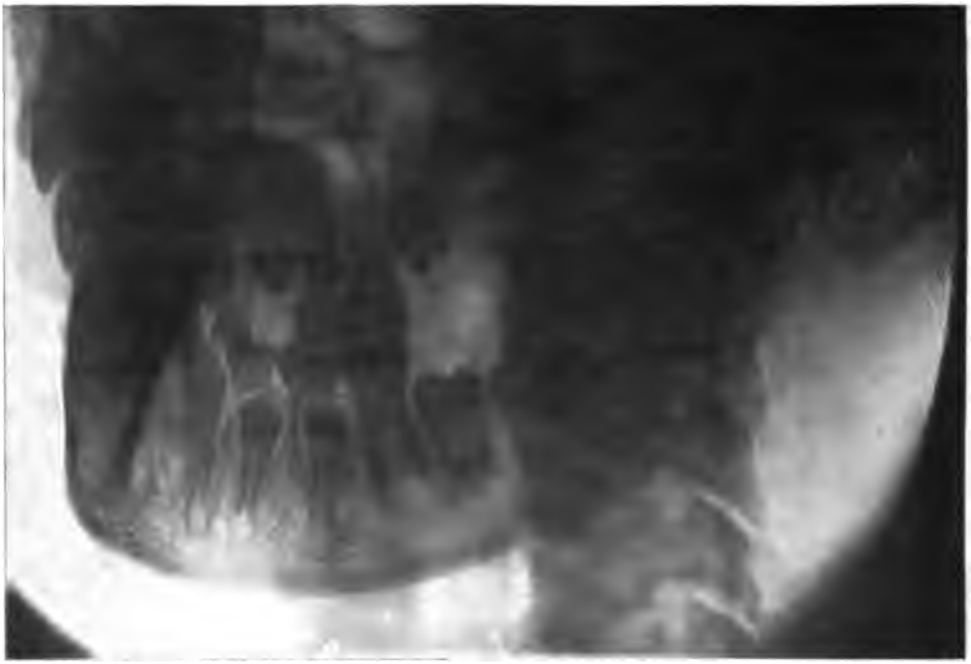


Fig. 5.—The successors to the deciduous teeth are shown, as well as developing second and third molars.

Fig. 6.—A very large alveolar abscess is visible below the mesial root of a lower molar.

causing it to start with a very dim light and gradually increase until a brilliant illumination is produced and vice versa. The face of this cabinet should be covered with ground glass so that the light will be free from shadows and equally distributed. An opaque mat with an opening the exact size of the plate under examination, should be placed over the ground glass so that the vision is not distributed by the light escaping from around the edge of the plate or

Fig. 7.—An alveolar abscess involving the roots of an upper central incisor and lateral incisor. No root canal fillings are present in either tooth.

Fig. 8.—An abscess is visible between the central and lateral incisors. Its origin could be due to either tooth or perhaps to both.

Fig. 9.—There is evidence of a small alveolar abscess about the apex of the root of the first bicuspid, while a larger one is shown to exist about the root of the second bicuspid.

Fig. 10.—Alveolar abscesses above two bicuspid teeth. The relationship of the abscess areas to the antrum is also shown.

Fig. 11.—Large alveolar abscess, chronic in character, about the apex of upper first bicuspid.

Fig. 12.—Large alveolar abscesses emanating from the upper lateral incisor and extending to the adjacent central incisor and cuspid.

film. Only by using a cabinet can radiographs be examined and interpreted to the very greatest advantage.

To one who has never seen a negative illuminated in this manner, the effect is almost startling in its beauty. As the x-ray negative is a transparency, a dim light behind it will bring out one set of shadows to their greatest clearness; an increase in the light will show forth still other effects, while a still

greater illumination will bring out the more dense portions of the negative, and in this way by varying the light in the illuminating box, each portion of the negative may be studied under a degree of light to bring out the maximum amount of detail.

Now with a print or lantern slide one can examine the field from only *a one light aspect,* and oftentimes in order to secure any degree of detail in the lighter or less dense areas, it will be found that the dense areas must be

Fig. 13.—Chronic alveolar abscess cystic in character, above an upper lateral incisor. Root filling material forced through the end of the root is plainly visible.

Fig. 14.—*A*. An upper bicuspid tooth with an alveolar abscess at its root apex. It will be noted that the root canal is improperly filled.

B. Shows the same tooth about two months after it was treated and the root canal properly filled. The rarified area about the apex has greatly decreased in size.

C. Shows the same tooth about six weeks later. The abscess area has entirely disappeared and the bone structure about the apex appears to be normal.

printed almost to an inky blackness. It should be obvious, therefore, that a single-phase print, or a negative, examined under ordinary conditions, cannot approach the various and comprehensive effects which are brought out by means of an illuminating cabinet.

In examining intra-oral radiographs, it is an advantage to place them in a film mount which will hold them securely and render it unnecessary to view

them while being held between the fingers. Such a "mount" should preferably be made of celluloid with one side clear and the other side dull, which allows the light transmitted to be of the same character as that coming through ground glass.

In examining negatives, we should bear in mind the fact *that very dense tissues are characterized by white areas,* while *less dense tissues appear darker,*

Fig. 15.—A necrotic area lying below a lower cuspid. It will be noted that there is not a distinct and abrupt line of demarcation between the light area and its surrounding tissue as is the case with alveolar abscesses, but the area gradually shades off from light into dark.

Fig. 16.—An area of necrosis about the roots of a lower first molar.

and the absence of tissue is indicated by blackness. To avoid confusion, we should remember that *in prints and lantern slides this color spectacle is reversed.*

Assuming now that we are familiar with the normal appearance of the dental structures under the x-ray, let us now consider some of the variations from their normal appearance which are found in the presence of pathological conditions.

As a tooth is much more dense than the bony structures of the jaw, any anomaly of form, size or position in the jaws is easily discernible even though it occupy a position far from what might be expected, as for instance, in the case of impacted molars, teeth in the antrum, etc. (See Figs. 1, 2 and 3.)

Fig. 17.—Small wires introduced into root canals to determine their length or the extent to which they have been opened, are easily differentiated from root canai fillings or tooth structure.

Fig. 18.—Root canal filling material forced beyond the root apex of an upper second bicuspid.

Likewise and for the same reason the presence in or absence from the jaws of successors of the deciduous teeth can easily be determined, as shown in Figs. 4 and 5.

Fractured roots or fractures of the bone even without displacement are often discernible at the line of fracture, owing to the fact that the line of fracture offers less resistance to the penetration of the rays and therefore is apparent upon the plate as a dark line.

Where an abscess takes place in the alveolar process, there is always an accompanying destruction of the cancellous bone tissue. Knowing that the absence of tissue is indicated upon the plate by a very dark or black area, such an area would indicate an alveolar abscess. "In fact, where these dark areas

are found in the alveolar process, ***and are not natural cavities,*** such as the antrii, or the nasal cavities, or such well defined nerve openings as the mental foramina, and where they are ***markedly circumscribed,*** that is, having a distinct and abrupt line of demarcation between the dark area and its surrounding tissues, we can in nearly every case, even if a clinical history be lacking, make the positive diagnosis of alveolar abscess." (See Figs. 6, 7, 8, 9, 10, 11, 12, 13, 14.)

Necrosis likewise appears upon the plate as a dark area, but differs in a

Fig. 19.—An abscess involving the pericemental and alveolar tissues about an upper first bicuspid.

Fig. 20.—An osteo-sarcoma of the mandible.

characteristic way from the ordinary alveolar abscess in that it is not circumscribed, ***namely, that there is not a distinct and abrupt line of demarcation between the dark area and its surrounding tissue,*** as is the case with the circumscribed infections, but ***the area gradually shades off from dark into light,*** portraying the progressive characteristics of this disease. (See Figs. 15 and 16.)

The different filling materials vary but little in the relative graduation of their shadows. Oxychloride, gutta-percha, and cement have about the same density, and when used as root filling materials, are plainly visible as light lines. Because they differ in density from cementum and dentine, the extent to which

they have been introduced into the root canals is easily discernible. Broken-off broaches and other instruments, or small wires introduced into root canals to determine their length or the extent to which they have been opened, because of their great density, appear very white and are easily differentiated from root-canal fillings or tooth structure. (Figs. 17 and 18.)

Where a destructive process has ensued in the peridental membrane, or in the bony wall of the alveolus (pyorrhea pockets) and is present on the mesial or distal side of a tooth, these conditions appear upon the plate as dark areas owing to the fact that the rays pass through them more easily, and effect the emulsion of the plate to a greater degree than if normal bone structure is present. The approximate extent of the destructive process is therefore easily determined. (Fig. 19.)

Cysts and tumors of the maxilla or mandible, owing to the fact that the character of the changes they bring about renders the areas involved less dense, their extent is visible upon the plate as a dark area. (Fig. 20.)

In seeking out the various anomalies and pathological conditions to which the teeth and oral structures are subject, *we should not be misled by indefinite shadows upon x-ray plates.* The very nature of these structures, their gross as well as minute anatomy, renders them somewhat difficult to radiograph, and necessitates a refinement of technic greater than that demanded with most of the other portions of the human anatomy. *Therefore, only radiographs made in accordance with a definite and exacting technic should be relied upon for diagnosis. If a doubt exists in any given instance, an additional or even several more exposures should be made, so that any conclusion reached will be founded upon definite evidence.*

Orthodontia and the General Physical Health

BERNHARD WOLF WEINBERGER (New York Medical Journal, April 22, 1916) discusses more particularly the subject of malocclusion, with reference to its etiology, effects, and treatment, and concludes that modern orthodontia requires a thorough knowledge of the physiological development of the dental arches and associated structures, the remote as well as the local etiological factors; proper diagnosis, classification, and treatment, based not only upon mechanical principles, but on physiological principles as well. A study of normal occlusion teaches that the full complement of teeth is absolutely necessary in order that the teeth may perform their proper function; extraction of teeth to accomplish this result is not only unnecessary but even criminal. Where the dental arches are arrested in their development, the development of the associated structures is also hindered. Therefore the orthodontist is dependent upon the rhinologist, and the rhinologist needs the assistance of the orthodontist. The disturbances of development begin early in life, consequently orthodontic treatment should be begun early, in order that cure may be completed by the time the second molars are in their proper position. Marked facial deformities can be corrected, allowing every child to develop normally, permitting functions of nutrition, digestion, and respiration.

ORAL SEPSIS AS A FOCUS OF INFECTION *

Its Bacteriological, Dental and Roentgenological Aspects

By Byron C. Darling, A.B., M.D., New York

Instructor in Orthopedics, College of Physicians and Surgeons, New York; Roentgenologist, St. Vincent's, and Ruptured and Crippled Hospitals.

The roentgenologist occupies an unique position between the physician and the dentist in his obligation to their patients. In cases of gastro-intestinal lesions, urinary calculi, and fractures, the physician or surgeon may be expected to know more of the condition than does the roentgenologist, and it remains only for the roentgenologist to interpret his findings to them. In the field of oral surgery, however, both physician and dentist may learn of the roentgenologist.

The radiograph, properly interpreted, is practically infallible in oral conditions. To no branch of the medical profession is the need of oral prophylaxis more evident than it is to the roentgenologist; I believe it, therefore, to be his duty and well within his professional province to teach and demonstrate to the medical and dental professions, and through them to the public, that oral sepsis is a focus of infection and a menace to the community.

Medical literature, along this line since 1911, is most interesting, and has been increasingly so since 1913. It remained largely for Rosenow to connect the focus with the systemic condition and to identify the bacteria present. This he has done until he is able to claim that the following list of diseases could originate in oral sepsis: arthritis,[12, 13, 14] myositis, neuritis, neuralgia, and migraine; myocarditis,[19] endocarditis,[14, 15, 16] nephritis, and thyroiditis; gastric and duodenal ulcers,[17] cholecystitis, appendicitis, and such obscure diseases as Hodgkin's disease, the leukæmias, and pernicious anæmia.[11] Over twelve years ago Rosenow, with the cooperation of Billings, began experiments on animals to prove this connection between the focus and the infection. His writings are so fascinating that the originals should be read.

In 1914, Dr. Thomas B. Hartzell[3] confirmed Rosenow's experiments. He sums up the work of Rosenow in these words:

"During a series of studies lasting over eleven years, Rosenow has shown that streptococci found in the mouth or tonsils can be made, under suitable conditions,[18] to change into typical and encapsulated lanceolate pneumococci, capable of causing rapid and virulent pneumococcemia; or under other cultural conditions to produce organisms which determine in the joints, causing arthritis deformans; and under still different cultural conditions to produce streptococcus viridans, which is the characteristic organism in heart valve lesions; and under still other cultural conditions to become capable of causing ulcers of the stomach and bowels. In animals, Dr. Rosenow has experimentally brought about heart lesions. Recovering his organism from the heart lesions and comparing it with the injected strain, he has in turn caused ulcer of the

*Read before the American Roentgen Ray Association, at Atlantic City, September 23, 1915.

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stomach. Recovering his organism from the ulcer of the stomach and comparing it with the original strain, he has caused joint infections. Again he recovered his organism from the joint, and has been able to produce typical pneumonia with an organism which originally was a harmless inhabitant of the mouth, and subsequently to recover from the diseased lung the original strain."

Referring to the alveolar abscess (Figs. 1-6), Dr. Hartzell says:

"In addition to osmosis occurring from the pockets and abscesses, we have

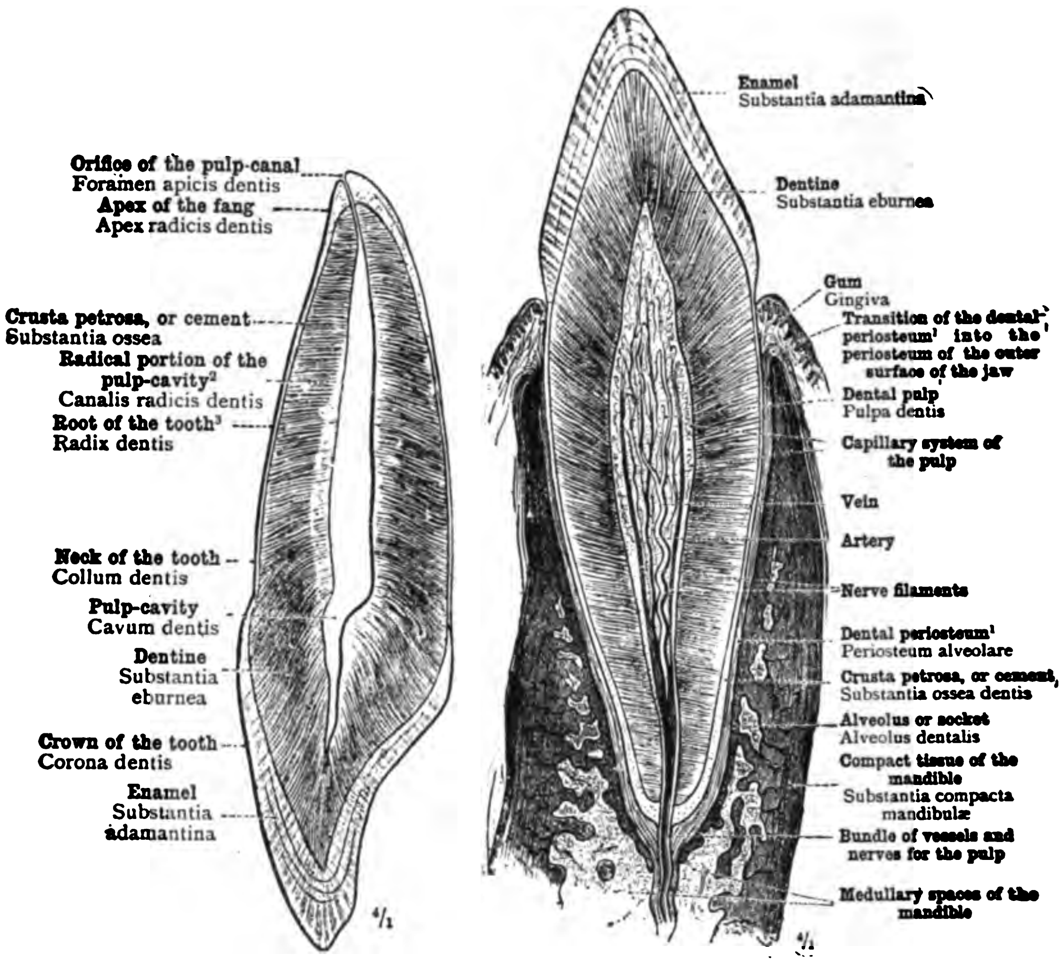

Fig. 1. Fig. 2.

Fig. 1.—Anatomy of the normal upper central or mesial incisor tooth in the sagittal section, the dentine, the enamel, the cement. (From Toldt's "Anatomy.")

Fig. 2.—Anatomy of the lower canine tooth with its pulp chamber, blood and nerve supply, alveolar process, periosteum (pericementum) and gum margin. (From Toldt's "Anatomy.")

the enormous force of occlusion to hasten the exchange of fluids between the lesion and the circulation. The pressure of occlusion acts as a piston pump against the peri-apical abscess and the lesion around the root (Fig. 6), applying by a pumplike action thousands of pounds in the course of twenty-four hours, thus hastening ordinary absorption."

Such investigations as these enabled Dr. Charles H. Mayo to say that "the

Fig. 3.*—Dry specimen (child): The normal alveolar process closely surrounds necks of teeth, roots, and apices. Here several teeth have as yet blunt, uniformed apices.

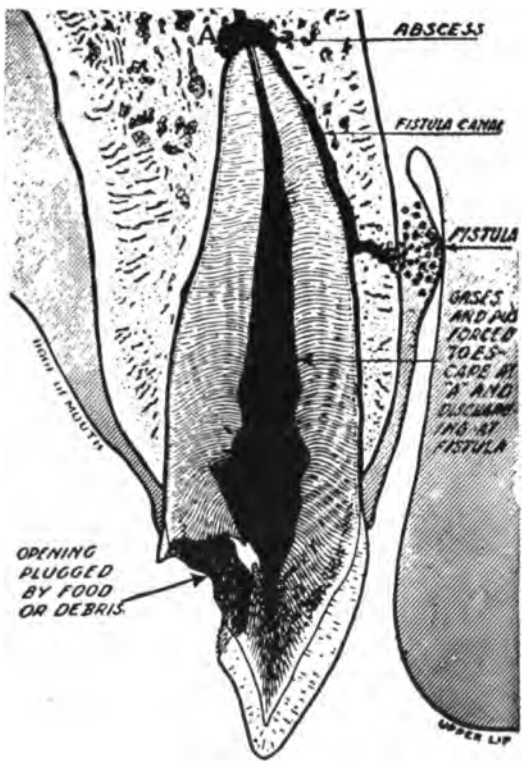

Fig. 4.—Diagram: The usual blind abscess (apical osteitis) has developed the less common fistula and gumboil. Compare Figs. 1, 2, 3, and 5. (Diagram by courtesy of the Ransom & Randolph Co.)

next great step in preventive medicine must be made by the dentists;"[6] and he adds, "Will the dentists make that step?"

The earliest writings I have found are those of Dr. Benjamin Rush of

*For permission to reproduce Figures 3-11 the author is indebted to the *Medical Record*.

Fig. 5.—Dry specimen: 1 and 1*a*. Decay of canine. Infection extending to the apex produced large area of necrosis anterior to the antrum. 2. Alveolar absorption from pyorrhea. Other teeth likewise. Compare with Fig. 6.

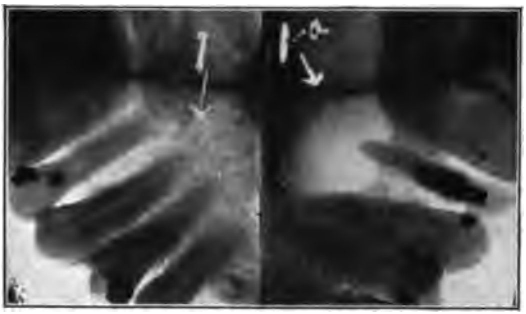

Fig. 6.—X-ray in the living: 1. Normal side showing cancellated bone detail. 1*a*. Large apical abscess (osteitis) following porcelain crown and pivot; infection caused by failure to empty and fill the canal. Such "whited sepulchres" must become diseased. Compare with Figs. 1, 2, 3, 4 and 5.

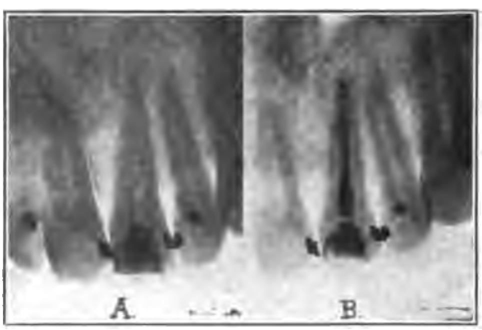

Fig. 7.—*A*. Tooth with wire in root, showing that the canal has been emptied (aseptically) to the end. *B*. Same tooth, showing root canal filled to the end. (Dr. R. Ottolengui.) Compare with Figs. 4, 5, 6 and 14.

Philadelphia, who said in his book, Volume 1 of "Medical Inquiries and Observations," as follows:

"Some time in the month of October, 1801, I attended Miss A. C. with a rheumatism in her hip joint, which yielded, for a while, to the several remedies

for that disease. In the month of November it returned with great violence, accompanied with a severe toothache. Suspecting the rheumatic affection was excited by the pain in her tooth, which was decayed, I directed it to be extracted. The rheumatism immediately left her hip and she recovered in a few days. She has continued ever since to be free from it.

Fig. 8.—Wet specimen: 1. Lower jaw. Snags or roots, a frequent source of apical osteitis. 2. Upper jaw. Extensive pyorrhea (Riggs' disease). Note the receded ulcerated gum, due to disease and absorption of the alveolar process beneath. Compare with Figs. 2, 3, 9, 10, 11 and 12 (1 and 4).

Fig. 9.—Dry specimen: Stripping of all the teeth from alveolar absorption, especially the molars, which have become loose foreign bodies. Compare with Figs. 2, 3, 8, 10, 11 and 12.

"When we consider how often the teeth, when decayed, are exposed to irritation from hot and cold drinks, and ailments, from pressure by mastication, and from the cold air, and how intimate the connection of the mouth is with the whole system, I am disposed to believe that they are often the unsuspected

causes of general, and particularly of nervous, diseases. When we add to the list of those diseases the morbid effects of the acrid and putrid matters which are sometimes discharged from carious teeth, or from ulcers in the gums created by them, also the influence which both have in preventing perfect mastication, and the connection of that animal function with good health, I cannot help thinking that our success in the treatment of all chronic diseases would be very

Fig. 10.—X-ray in the living: Extreme stripping from pyorrhea (Riggs' disease). Even ends of the roots, as well as the entire alveolar processes, are absorbed. Note the unclean bridge on the lower front incisors. Compare with Figs. 2, 3, 5, 8 and 9.

Fig. 11.—X-ray in the living: Long history of arthritis. 3 and 4.—Crowned teeth with root canals not filled, showing slight apical osteitis. 5, 6, and 7.—Crowned fifteen years; roots completely stripped from alveolar absorption (pyorrhea) or from extension of apical osteitis; canals never emptied or filled. 8.—Root lost through disease. Compare with Figs. 2, 3, 5, 9 and 13 (1, 3 and 4).

much promoted, by directing our inquiries into the state of the teeth of sick people, and by advising their extraction in every case in which they are decayed. It is not necessary that they should be attended with pain, in order to produce diseases, for splinters, tumors and other irritants before mentioned often bring on disease and death, when they give no pain, and are unsuspected

as causes of them. This translation of sensation and motion to parts remote from the place where impressions are made appears in many instances and seems to depend upon an original law of the animal economy."

Fig. 12.

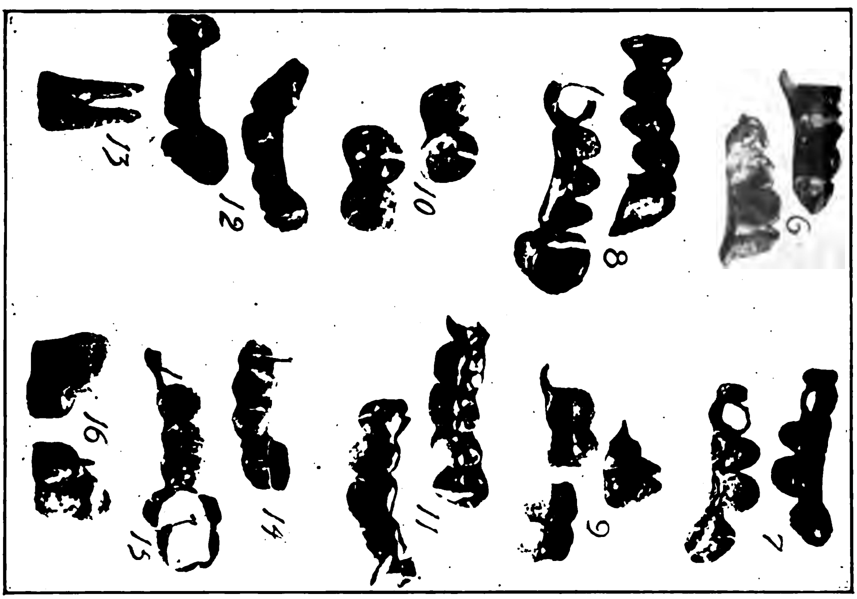

Fig. 13.

Although, as early as 1887, Alfred Mentel, of England, had pointed out the relationship between the tonsils and rheumatic fever, and had proven that the tonsil is a path of entrance of the streptococcus to the blood stream, and although, over forty-three years ago, Pasteur established infectious bacteria as

the specific source of disease, our contemporary literature on oral sepsis as a focus of infection dates back only fifteen years. When, in 1910, William Hunter,[4] of London, definitely pointed out septic dentistry as a possible source of disease, the medical profession paid little attention to it. More emphatically again in *The London Lancet* of January, 1911,[4] Hunter came out with his expression "American Dentistry." (Figs. 6, 10, 11, 12, 13 and 14.) This article, badly abstracted in *Current Literature,* aroused and stimulated American dentists, and marked the date of the beginning of their serious and keen work of investigation and experimentation.

PROSTHODONTIA.

SPECIMENS OF WORK FROM PROMINENT MEN.

These specimens are not the work of all-around incompetents: authors, clinicians, professors of prosthodontia figure among those at whose doors the existence of these specimens may be laid; men who, in some instances, are not so painstaking, that they fill the root canals of multiple-rooted teeth with gold-foil, then crown these teeth in the manner here shown, and execute the bridgework in this faulty fashion. The more carefully one examines these specimens in full detail, the firmer grows the conviction that such work is empirical and without any scientific foundation.

Fig. 12.

Figs. 1, 2 and 3 represent the aftermath of what a certain patient carried in his oral cavity, placed there by a practitioner who considers himself, and is considered by a great many, to be above the average in the skilled construction of bridgework. It will be noted that the crowns do not come within an eighth of an inch of fitting the necks from superficial examination the phonetic deficiency of the appliance must be apparent. In order to support the four lower incisors the practitioner restored to the fixation of the entire number of lower teeth, and thus defeated his purpose and the patient's well-being of the pier teeth; that no attention has been paid to contour labio-lingually; that even by robbing all of his lower teeth of the essential individual tooth motion. The necessity for interdental space was entirely ignored, and the occlusal surfaces of the two upper pieces, right and left, show nothing short of charlatanism. The square of the surface left to accumulate filth is equal to the squares of both surfaces, labial and occlusal respectively, so that while the two latter are kept automatically clean, one by the cheeks and the other by the work of trituration, the one that cannot be automatically cleaned was made the largest in area. Why?

Fig. 4. From the hands of the same master craftsman: note the quarter of an inch deficiency in the fit of what the practitioner undoubtedly called a cuspid crown. Note the lack of labio-palatal restoration, and hence interference with proper enunciation, and also please observe the final loss of the piers. Let us pass on to the next one with the thankful thought that we did not compound the felony by copartnership in the specimens so far shown.

Fig. 5. Particular attention is called to Fig. 5. An anterior bridge running back on the left side to the second bicuspid; on the right side, ditto. From every point of view, one of the worst examples of bridgework and a foul insult to a patient's intelligence, as well as a death blow to anyone's good health, constructed by one of New York's greatest porcelain specialists, actually doing work for the dental profession. It is surmised that the skill he displayed manifested itself in the addition of a little porcelain to the gingival borders of the teeth—a trap for filth and an everlasting shame for the man guilty of this product.

Compare with Figs. 10 and 11.

Fig. 13.

Fig. 6. This is shown in order to bring out the contention that bridgework, as it is being practiced, is a chaotic jumble. The practitioner who is responsible for this specimen is a clinician of national reputation, when it comes to filling root canals with gold foil. The specimen shows considerable knowledge of root preparation and absolute lack

of proper relation and of labio-lingual restoration. It is the half knowledge that seals the fate of a piece of bridge work, even before it is put to any test; here we find no occlusion and no evidence of knowledge of the physics or dynamics of bridgework.

Fig. 7. A piece of rigid lower bridgework—may the gods forgive me for giving it the name! It shows an absolute lack of any of the knowledge with gold foil. The specimen shows considerable of this kind. Please note the lack of occlusal provision; lack of the sense of preparation; lack of interdental spaces, and pray consider that at one time there was a man who tried to collect a royalty from every man practicing bridgework, for he claimed it as his invention; and then reflect upon the fact that Fig. 7 is the creation, the handiwork of his first assistant. One may by an insignificant stretch of one's imagination see a blue line emanating from Fig. 7, and if one looks intently enough upon the blue line it will curl into the letters which make up the words, "The patient be damned!"

Fig. 8. This is shown to illustrate the lack of knowledge of the simple fact that if a tooth be divided into three equal parts, gingivo-morsally, its greatest circumference is at the gingival plane of the morsal third, and its smallest diameter at the gingival plane of the gingival third. The rest of Fig. 8 is of no further interest, because it lacks anything which would entitle it to serious consideration, if it were not that it has been responsible for the development and growth of X million bacteria and the loss of a sound molar tooth. This was constructed by one who seriously takes himself as an expert crown and bridge worker.

Fig. 9. This shows an intelligent (?) attempt to restore two teeth by a method of slotting the artificial fixture and running it upon a supposed-to-be parallel bar. No allowance is made for vertical stress; none for latero-rotary stress; the labio-lingual restoration is faulty, and the method of procuring distal anchorage is mechanically unsound. Like a dutiful specimen it came back to tell of all the discomfort it had caused its proud (?) and glad (?) possessor during a period of a short six months or so. Its creator: a president of a dental something or other, a clinician of State reputation; an expert with Ascher's enamel, etc.

Fig. 10. This shows a more comprehensive knowledge of crown construction and was made by a professor of prosthetic dentistry in a western institution. Presented because it exhibits the folly of attempting to obtain union between crown and dummy anywhere except upon the mesio-morsal and disto-morsal lines respectively; had this been done in the specimen here submitted the interdental space would not have been encroached upon, the area would not have become severely inflamed, and the work might yet have been in the oral cavity; though the gingival part of the facial palatal restoration was decidedly wrong.

Fig. 11. A failure of the better class, and perhaps responsible for keeping this infernal bridgework alive so long. Constructed by a so-called topnotcher—yea, with an office on Fifth Avenue. Further remarks would be uncharitable. Let the specimen speak for itself.

Fig. 12. A vile example of a Sixth Avenue dental fakir. This is commonly called bridgework, and while it looks "fierce," as Myra Kelly would have said, in mechanics it is no worse than a good many of the specimens submitted earlier.

Fig. 13. Two Richmond crowns showing a great deal of care in construction, a knowledge of what was required, but evidently an impossibility of execution. Hence failure resulted, due directly to an ill-fitting band and consequent peridental irritation. Nevertheless, the effort of a conscientious workman.

Figs. 14 and 15. Specimens from one of Hubbard's Immortals showing such a lamentable lack of knowledge that a summary of their faults will suffice:

(1) Lack of knowledge of tooth preparation.
(2) Lack of knowledge of importance of interdental space.
(3) Lack of knowledge of proportionate size of teeth.
(4) Improper labio-lingual restorations.
(5) Ignoring vulnerability of soft tissues of buccal cavity.
(6) Uncleansable area twice as large as cleansable one.
(7) The result of all the foregoing was a year of unspeakable torture for the patient, now fully restored.

Fig. 16. A central and lateral incisor carried on pivot, insufficient to support one tooth, yet asked to support two. The piece shows an absolute disregard of all the rules

that should govern the construction of such work, and yet the man responsible for it is a porcelain specialist of New York City, and enjoys a national reputation. If it were possible to reproduce colors in the illustration, it would show an enviable amount of ignorance of the laws that govern the production of colors; enviable, since they say that ignorance is bliss. It is needless to say that the duration of the appliance was just about the time that elapses between two rooster crows, and such is a specimen of time-honored and long-heralded porcelain bridgework.

A sufficient number of examples has been shown to compel the conclusion that the schools and colleges for dentistry are deficient, or such specimens could not exist. The methods for conveying the scientific, the accurate, the absolute in dentistry, the methods of teaching this character of work, are wrong because they are constructed upon false foundations, and no amount of trimming will bring them into plumb.

The writings of roentgenologists on the subject are few, but emphasize the diagnostic value of radiography to the dental profession; as, for example, Pfahler, in *Roentgen Rays in Dentistry*, 1909;[8] Lange, in an article just previous to it; and MacKee, in *The X-Ray in General Dentistry*, 1913.[6]

The medical profession was not then alive to tonsils or teeth as foci of infection. Let it be carefully noted that the dental profession was not false to the trust that was, from its very nature, theirs to warn the medical profession. As early as 1881 we find dentists writing on the subject; namely, L. C. Ingersoll, 1881;[5] A. Witzel, 1882;[23] W. J. Reese, 1886;[11] Louis Jack and C. N. Pierce, 1892-1895;[9] and others between 1880 and 1900. In 1901, Weston A. Price, Doctor of Dental Surgery, of Cleveland, said:[10]

"We will now turn our attention to the dentists' graveyard, root canal fillings (Figs. 4, 5, 6, 10, 11, 14), where so many cover up defective, careless work, trusting it will never come to light, and often reminding the patient that when his tooth gives trouble again it will have to be extracted. Humanity should thank God for a new light that will go into these dark places and show up what is often criminally careless or wilfully bad work in filling roots. True, it is often impossible to properly fill roots, but if all were as well filled as possible, those imperfectly filled would be only those with so small a canal or so little of it unfilled that the woes of humanity from this source would be infinitely less than they are."

In 1906 there followed an article by M. J. Schamberg,[22] then of Philadelphia. In 1908 *Items of Interest* published a paper by M. L. Rhein,[12] of New York, and made the following editorial comment on it:

"The complete removal of canal contents has been the bugaboo of dentists since dentistry began. Perhaps no single operation has been more written upon, and yet with the hundreds of methods which have been described as adequate, even today, if a man dare say that he can reach the apices of even the majority of tooth roots, not a few of his hearers will believe that he is either self-deceived or else a willful falsifier and a braggart. Yet certainly it is high time, for the honor of American dentistry, that this attitude should pass and that root canal treatment should be as skillfully (Fig. 7) and as successfully done as are other operations, for there is nothing in dental practice of so great importance. Of what advantage can it be to a patient for a practitioner to insert a perfectly matched porcelain inlay, or a perfectly occluded gold inlay, or a marvelously constructed bridge (Fig. 10), if the canals of the supporting teeth have been inefficiently cleansed and filled?"

In November, 1909, Professor I. N. Broomell[1] said, regarding the practice of insertion of large gold fillings near living pulps, and likewise of placing of gold shell-crowns without removal of the pulp (Fig. 11), as follows:

"As a result of the microscopic study of a number of cases, it is proposed to show that almost invariably the pulp tissue, and as well the enamel, dentine, and alveolo-dental membrane, are all more or less affected in various ways by such unnatural surroundings. Among the morbid effects produced are hyperemia of the pulp, dry gangrene of the pulp, calcification of the pulp tissue, sclerosis of the blood-vessels of the pulp, atrophy of the pulp, pulp nodules, secondary dentine, expansion of the dentinal tubules, with corresponding bulging of the dentinal fibers, pathologic pigmentation of the enamel and dentine, non-

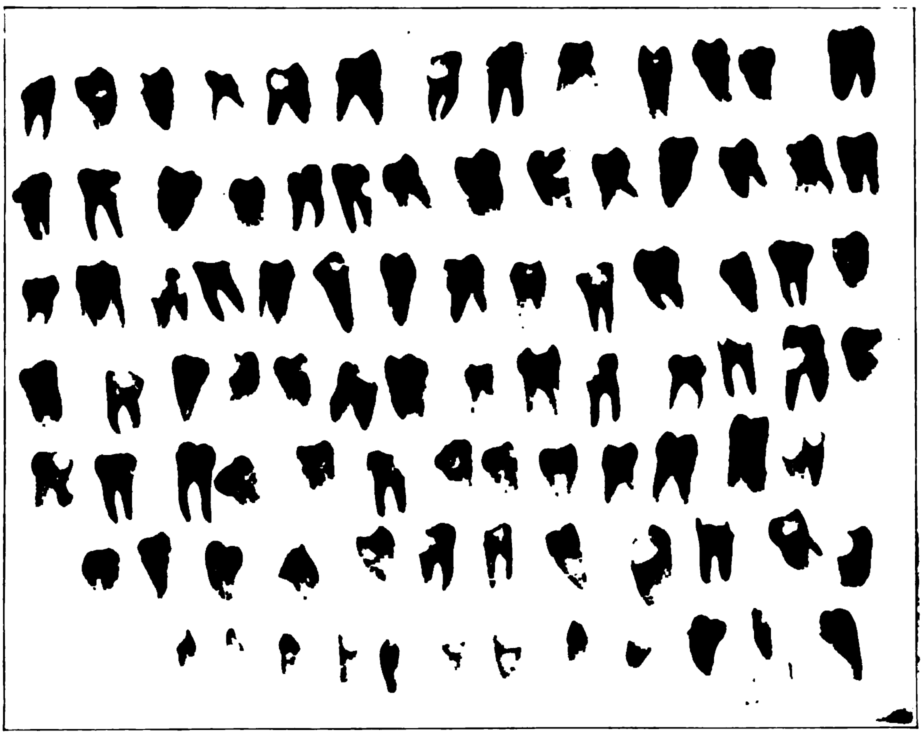

Fig. 14.—Note how the roentgenogram reveals the universal lack of proper root canal filling in teeth taken at random from the office of an extractionist in New York. Scientific root canal work in time would have saved almost all of these teeth for years of use. Compare with Figs. 3, 4, 5, 6, 7, 8 and 9. (By courtesy of Dr. W. H. Haskins.)

carious destruction of the enamel, as well as destruction by caries and perhaps a molecular change in this tissue. Any one of the foregoing may be the primary affection, after which a train of pathic conditions may ensue."

In 1910, covering the matter of mechanics and practice of bridgework, Dr. Herman E. S. Chayes[2] writes:

"At best one is brought face to face with results that are unsatisfactory, incomplete, unwholesome and unclean, etc., etc. These specimens (see Figs. 12 and 13) are not the work of all-around incompetents; authors, clinicians, professors of prosthodontia, figure among those at whose doors the existence of these specimens may be laid."

As further proof of the attitude of the progressives of the dental profession, Dr. R. Ottolengui's editorial comment on the above closed as follows:

"It is not the writer's intention to leave the impression that such evils as are here described are representative of typical American dentistry. Quite to the contrary, no one better than he knows that perfectly scientific, thoroughly aseptic, and entirely sanitary dental operations (Fig. 7) are done daily by thousands of dentists in this country. Yet it is likewise true, and pity 'tis that 'tis true, that thousands of other dentists do exactly that sort of work which Dr. Hunter so aptly terms 'septic dentistry.'

"Perhaps the great underlying reason of this may be found in the fact that neither the surgeon, the physician, the dentist, nor the patients themselves fully realize the dangers that threaten the whole body if the oral cavity be a secret storage place for 'oral sepsis.' When the people come to understand

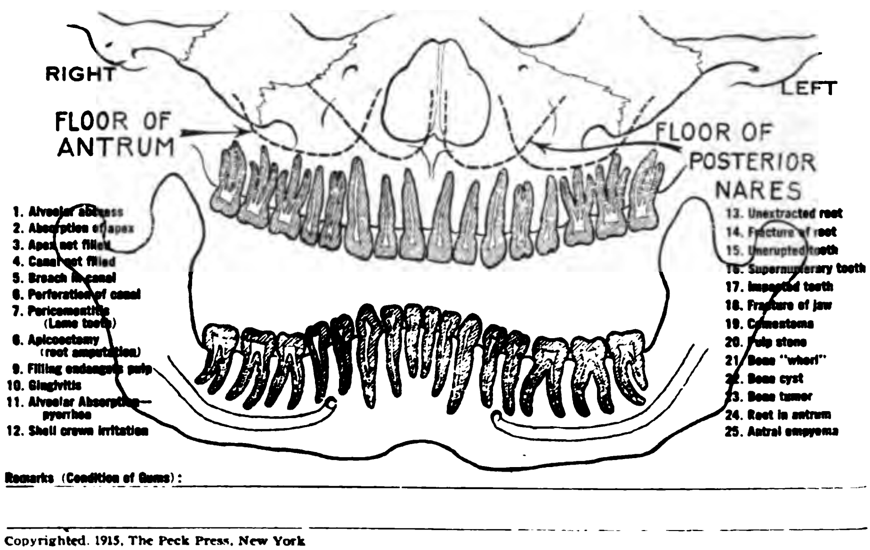

Fig. 15.—The Dental Chart, a 4x6 inch card in two colors for diagraming the composite x-ray findings, makes graphic and definite record for the physician and dentist and saves time. The diagram itself is in red ink and the findings are drawn in with black India ink.

that their very lives depend upon sound teeth in a clean and healthy mouth, then, and not till then, will they cheerfully pay an adequate fee for competent dental service, and in that day more dentists will practice, because they can then afford to practice thoroughly 'aseptic dentistry.' "

Nor has anything materially different been said on the subject of dying or dead pulp, root canal fillings, gold or porcelain fillings, or inlay work, crown, or bridge work. These men were pathfinders. Their colleagues have been stumbling or speeding along the way, as the custom has been and always will be. Mistakes were made, which is the point that concerns the medical profession.

The period of the dark ages in dentistry began propitiously enough when carious teeth were saved by fillings (Fig. 14). But soon mechanical dentistry became so ambitious that the dentist began to regard the loss of a tooth as the physician does the death of a patient. Their patients, even sensible men and

women, by the same token grew so vain that the loss of a tooth was a shock and forewarning of approaching dissolution.

In any roomful of adults, such as this, it is the exception if any mouth has not at least one pyorrhea pus pocket, or blind or fistulous alveolar abscess. Nor can children, with their carious and dead temporary teeth, be excepted. The radiograph visualizes the destruction caused by oral sepsis. The best dentists admit its existence and are striving by every means at their command to remove and remedy the mistaken technic of the past and by perfecting their technic to avoid it in the future, at the same time advising prevention as worth more than cure.

It is my purpose, in as few words as possible, to take up the practical matter of the scope of the report that I make, one copy of which I send to the physician for his files, and one copy of which I send to the dentist. The films are also made in duplicate, one set being kept on file, and the other sent to the physician, who may give them to the dentist for his guidance. Lately I have had a chart made (Fig. 15) on a four by six card, which I have had passed around, hoping by this graphic means to save time in making a report and to give a better guide to the dentist or physician. On this chart one can draw a composite of several films taken at different angles.

Sooner or later in doing this work, the roentgenologist is likely to be called upon by the physician to give advice as to the need of extraction, etc., and to explain dental procedures to correct the given condition. To do this, one must become well informed as to the practices of old as well as of modern dentistry. For that reason I have given you quotations from the works of the dentists themselves. It is well to read the dental journals, which are now full of this subject, in order to keep abreast of their work.

In cases of pyorrhea (Figs. 8 to 11), in connection with some serious systemic condition or incapacitating arthritis, for example, thorough extraction must be considered, first taking several cultures for autogenous vaccine treatment. In all cases, faulty long shell crown and fixed bridgework (Figs. 12 and 13) should be removed and replaced by that which can be kept clean.

A loose tooth, if there is enough sound and healthy alveolar process left to hold it (Fig. 10), must have all the lime deposits scaled off frequently. The Emetin Treatment should be considered, although it is variously criticized, as the end-amœba is only one of the one hundred and fifty bacteria present. The diet should be carefully considered along present-day findings. Meat-free and similar diets were strongly advised at one time, on the ground that the condition is systemic and metabolic, not local, and that herbivorous animals are free from pyorrhea. Many of these cases resist every treatment, and extraction is finally necessary.

In cases of blind or fistulous alveolar abscesses (Figs. 6 and 7) the procedure is even more complicated, and action should be more or less radical, depending on the patient's condition.

Too many root canals were never emptied or filled. Canals filled with so-called antiseptic cotton do not show in the radiograph. They should be condemned and the filling removed in all cases. Paraffin fillings do not show in a radiograph, but if there is an apical lesion the canal should be emptied. Gutta-

percha, either alone or combined with a metal, is more commonly used and shows well in the radiograph (Fig. 7).

There are three ways of treating an apical abscess which have supplemented the old method of emptying the canal, draining it with wisps of cotton, and injecting antiseptics until such a time as healthy granulation shall have replaced the abscess cavity. This method requires a large canal opening, and in the lower jaw, with gravity opposing, the drainage is doubtful.

The first of the newer methods, which is advocated by Dr. M. L. Rhein and claims good results, requires ionization with antiseptics. It would seem surgically possible, however, to empty the canal and, after a short period of drainage, to refill it aseptically solid to the apex, first checking the procedure by radiographing the tooth with wires in place (Fig. 7) to show that the apex was opened and emptied, and again radiographing it to determine whether the opaque filling is flush with the apex. Thus, the blind pocket in the apical canal being obliterated by the filling, healthy granulation should take place, and callus and bone repair follow (Fig. 7).

Second, when a canal cannot be emptied or filled to its apex on account of curves, or when it has been accidentally perforated, the unfilled portion may be amputated through the alveolus and the wound repacked over a long period until the usual repair takes place.

The third method, which I would emphasize, is extraction. When ever this is advisable a careful culture should be made of the tooth apex and socket on blood serum for an autogenous vaccine, for the culture if lost can never be regained. If not needed immediately some later exacerbation of the patient's condition may indicate its use.

In calling the physician's attention to these details of oral conditions, it is not my purpose to wade too deeply into the waters of dentistry, but rather to impress upon your minds that by comparatively simple procedures of dentistry urged upon the patient in time, the physician may be spared much anxiety and the patient may be greatly benefited.

BIBLIOGRAPHY.

[1]Broomell, I. N.: "The Adventitious Effect of Large Masses of Gold in Contact with Tooth Tissues." Dental Cosmos, April, 1910—389.

[2]Chayes, H. E. S.: "Empiricism in Bridgework." Items of Interest, October, 1910—754.

[3]Hartzell, Thos. B.: "Secondary Infections Having Their Primary Origin in the Oral Cavity." Jour. of All. Dental Soc., June 1914.

[4]Hunter, Wm.: "An Address on the Role of Sepsis and Antisepsis in Medicine." London Lancet, Jan., 1911. "An English Physician's Denunciation of American Dentistry." Current Lit., Aug., 1911.

[5]Ingersoll, L. C.: Ohio State Journal Dent. Sci., 1881, i, 189.

[6]MacKee, G. M.: "The X-Ray in General Dentistry." Items of General Interest, June. 1913.

[7]Mayo, C. H.: "Mouth Infections as a Source of Systemic Disease." Jour. A. M. A., Dec. 2, 1914.

[8]Pfahler, G.: "Roentgen Rays in Dentistry." Jour. A. M. A., 1909, Vol. liii, 770.

[9]Pierce, C. N.: International Journal, 1892, 1894, 1895, xiii, xv and xvi.

[10]Price, Weston A.: "Practical Progress in Dental Skiagraphy." Items of Interest, June, 1901—458.

[11]Reese, W. J.: Dental Cosmos, 1886, xxv, 550.

[12]Rhein, M. L.: Items of Interest, Nov., 1908—833.

[13]Rosenow, E. C.: "Mouth Infection as a Source of Systemic Disease." Jour. A. M. A., Dec. 2, 1914—2026.

[14]............. "Etiology of Arthritis Deformans." Jour. A. M. A., 1914, lxii, 1146.

[15]............. "Relations of and Lesions Produced by Various Forms of Streptococci with Special Reference to Arthritis." Med. Jour., iii.
[16]............. "Etiology of Acute Rheumatism, Articular and Muscular." Jour. Infect. Dis., 1914, xiv, 61.
[17]............. "Lesions Produced by Various Streptococci, Endocarditis and Rheumatism." Med. Jour., 1914, xcix, 253.
[18]............. "Studies in Endocarditis and Rheumatism." Journal-Lancet, 1914, xxxiv, 1.
[19]............. "The Production of Ulcer of the Stomach by Injection of Streptococci." Jour. A. M. A., Nov. 29, 1913.
[20]............. "Transmutations Within the Streptococcus-Pneumococcus Group." Jour. of Infect. Dis., 1914, xlv, 1.
[21]Rosenow, E. C., and Coombs, C.: "Myocardial Lesion of Rabbits Inoculated with Streptococcus Viridans." Lancet, 1913, ii, 1677.
[22]Schamberg, M.: Dental Cosmos, Jan., 1906; Dental Brief, June, 1906.
[23]Witzel, A.: Vierteljahrschrift f. Zahnheilkunde, 1882. British Jour. Den. Sci., xxv, 153.
[24]Editorial, Items of Interest, Nov., 1911—875.

Dental Disaster

ENERGETIC internists are grasping at infected tonsils and teeth with an alarming enthusiasm. No doubt these organs have been guilty of many remote infections. The tonsils seem to be quite rightly accused and convicted as primary offenders. The tonsils are wholly within the realm of medicine, and physicians need not argue tonsillar guilt with another profession. But the teeth—poor things—are being accused by physicians and defended by dentists. The dental radiograph has stepped in to promote the physician's case and to confuse the dentist. There is no doubt but that pathologists have shown that organisms, capable of remote infections, are found about the apices of diseased teeth. Consequently the physician is prepared to sacrifice the offending teeth immediately with the same assurance that he sacrifices tonsils, appendices and gall-bladders. But the dentist is not ready to see his pets sacrificed without a more thorough trial. He argues that infection about the teeth can be controlled by conscientious and painstaking dental surgery and that carelessly to extract these important organs places the individual at a distinct digestive disadvantage,

> " . . . . , puzzles the will
> And makes us rather bear those ills we have
> Than fly to others that we know not of."
> Hamlet, Act III, Scene I.

There appears to be little doubt, and dental radiography seems to prove. that there are more infections about teeth which have been the victims of American mechanical dentistry. Also it is true that dangerous granulomas arise at the apices of injured teeth without previous dental attention. Many contributions (notably Rhein's) appear to prove that these granulomas may be completely healed by proper aseptic root-fillings. Is it necessary then to sacrifice teeth and force the patient to bridges and plates? It spoils two good teeth to anchor a bridge, and unless the anchor teeth are aseptically prepared the patient has two potential sources of infection where one previously existed. Plates may be uncomfortable, distort taste impressions and require unceasing attention to cleanliness. Bridges and plates, therefore, interfere with digestion and consequently the health and happiness of the patient. The human race as it is

constituted today cannot hope to avoid the route of the Dinosaurus if the teeth are to be continually sacrificed.

The teeth must be preserved and used for their original purpose of mastication or they will contrive to make trouble. Perhaps the increase in soft prepared foods for children prevents the development of sound teeth. It requires exercise to develop muscle and study to develop brains and, likewise, mastication to develop healthy teeth. Otherwise muscles become flabby, brains stagnate, and teeth lack resistance and become soft, inviting infection. Again, dentists have not generally appreciated surgical cleanliness—asepsis. They are where surgery was twenty-five years ago in the antiseptic stage. Dentists still seal antiseptic preparations in root canals to eradicate infections. This is contrary to accepted surgical authority.

It would seem that it is necessary to inject much which is known in surgical pathology into dental teaching and also teach dentists the principles of surgical asepsis. Failure along these lines has forced physicians to advise the sacrifice of teeth. The conflict is still waging.—*Dr. Edward H. Skinner, Interstate Medical Journal.*

Relation of the Teeth to Tuberculosis

AN examination of oral conditions in 297 cases of tuberculosis in a sanatorium showed: Bad condition of the mouth in fifty-one per cent; bad condition of the teeth in forty per cent; bad condition of the gums in fifty-one per cent, and pyorrhea in thirty-five per cent. It is a question whether the tuberculous disease and mixed infection in these patients arose through the condition of their teeth and gums or whether their tuberculous condition affected the teeth and gums secondarily. It is assumed, at any rate, that a bad condition of the teeth and gums affords a good medium for the growth of the tubercle bacillus, which has often been found in teeth containing cavities. Sore teeth and tender gums may, moreover, be the cause of insufficient and ineffectual mastication. The author establishes a contrast between the general results obtained in the female and male patients in the sanatorium, the former being much more careful and obedient in the care of their teeth and gums than the latter. The male patients, placed under the same solarium treatment as the female, have not shown the same percentage of good results. Freudenberger is convinced that the care and time spent by female patients in keeping their mouths clean has assisted materially in bringing about a marked improvement in their general condition. The tuberculous patient with clean teeth and good gums has a better chance of quiescence or arrest of the disease than one in whom conditions in these respects are bad.—*H. Freudenberger, Lancet-Clinic.*

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EDITORIALS

Dental Laws and the State Board

AS those engaged in the practice of dentistry in America increased in number, various laws in different states were passed to regulate the practice of that profession. The enactment of these laws was also influenced more or less by the advent of the dental college and the raising of the educational requirements by the National Association of Dental Faculties. The result of these efforts at regulation has been the establishment of state boards for the purpose of examining those who intend to practice dentistry. That the present methods of these boards are not satisfactory is proved by the many efforts that are being made to change the present laws and to place the state board examinations on a more uniform basis. Regardless of how efficient or how inadequate a law may be, there are always some persons to oppose a change. There is no question that the public should be concerned in the regulation of the practice of dentistry, as the laws are made for its protection, but practically all efforts for

the enactment of medical or dental laws are promoted by the profession and not by the public. There has also been more or less disagreement between various organizations, and in some instances between state boards and dental colleges, which has caused needless conflicting laws in different states.

The medical profession has advocated the creation of a national examining board, which shall pass on the qualifications of every graduate in medicine, regardless of the state in which a graduate expects to locate. While this would probably be the ideal plan, a difficulty arises on account of the provisions of state laws, which give each state certain sovereign rights, especially in regard to police powers. If Congress would form a department—known, we will say, as the Department of Public Health—which would be governed by a secretary the same as are the war, navy, and treasury departments, and medical and dental examinations be taken out of the hands of the states, and placed under the supervision of this department, matters would be greatly simplified. It is, however, needless to say there would be a great deal of opposition to such a plan, as it would be considered a centralization of power, would eliminate a large number of state boards, and cause the abolishment of offices occupied by certain men. It is rather unfair to expect a student who has been graduated from a medical or dental college to pass the state board examination in whatever state he expects to practice. If he is qualified to practice in one part of the United States, he should be qualified to practice in another. There seems to be no sound argument against this, and the only opposition comes from the resident members of the profession in a state. We have often heard it stated both by medical and dental men that they did not intend to have their locality overrun by men coming from other states to practice. It is known that in certain states of the United States it is practically impossible to pass the examination before the state board unless one is "a native son," or a graduate of a certain school located in the state in question. In other words, some state boards have assumed a protective power whereby they intend to protect the dental profession of the state from competition, regardless of the ability of the dentists in that state, or of the proficiency of the man who desires to locate there. This is a very unfair and narrow view but nevertheless that view prevails in some sections.

In regard to the status of orthodontia in respect to the state boards, we find a very undesirable condition existing. For example, a man may be qualified to practice orthodontia, having obtained that qualification either by years of practice or by a special line of training, and, if he desires to locate in another state, he is compelled to pass all the examinations required of a man who intends to practice general dentistry. It is desirable to have a certain examination for the man who is to specialize in orthodontia, and that examination should be of a character to determine his fitness for that specialty. It should be more exacting along certain lines than the examination required for the man who is to do general dentistry. It should also be compulsory for a man who intends to give up general practice and engage in orthodontia to present a recommendation or pass an examination to prove he is qualified to practice orthodontia as a specialty. Unfortunately, as conditions exist today, a man may be a failure in dentistry and decide over night that he will engage in orthodontia, and the

public has no way of protecting itself. We have known of a few instances of men who qualified themselves to practice orthodontia, and decided to locate in states where they were not registered to practice dentistry, and, because they would compete with some man who had influence in a state and with the state board, they had considerable difficulty in obtaining a license. In one case a man was informed that if he would change the locality he had in view and go to another town, he would have no difficulty in passing the state board. These conditions point to the need of a more centralized plan of medical and dental examinations, and emphasize the necessity of having a special examination for those intending to engage in the practice of orthodontia, and of making every man pass that examination, whether he be native born or a foreigner. Just how this proposition will be worked out will be a question of the future, and it is a question that demands a logical solution.

The Department of Dental and Oral Radiography

WITH the first issue of the *International Journal of Orthodontia,* we announced that the Journal would be devoted to the advancement of the science of orthodontia and the correlated subjects. We have tried to adhere to that policy both in the publication of articles and in the editorial columns. Realizing the advantage to the dental profession of a department devoted exclusively to the x-ray and its application in the various branches of practice, and believing as we do that radiography is closely related to orthodontia, we have inaugurated with this issue a Department of Dental and Oral Radiography, under the direct editorship of Dr. James David McCoy, of Los Angeles, Professor of Orthodontia and Radiography in the College of Dentistry of the University of Southern California.

Every dental practitioner knows that the x-ray is a valuable asset to dental practice, but comparatively few realize the extent of its usefulness, or to put it more definitely, few realize that this agent is absolutely indispensable if the dentist fulfills his professional obligations.

Doubtless many will consider such a statement as being ultra radical, and if so, they are at liberty to offer proof to the contrary. In the meantime, it will be the policy of this Journal to assume that the x-ray is indispensable to the dentist who fulfills his professional obligations, to encourage its more universal adoption by dentists as a regular part of office routine, and through its pages instruct those who are interested.

Those who are familiar with the development of orthodontia within the last ten years know that radiography has been an invaluable adjunct to the practice of this specialty. It was the orthodontist who first used the radiograph in dentistry for the location of missing and supernumerary teeth. We can well remember when a radiograph of the teeth and jaws was considered a scientific curiosity. After having successfully employed the radiograph in the diagnosis of missing and supernumerary teeth, its field of usefulness was then extended to the study of the movement of teeth and much of our present knowledge of the tissue changes during tooth movement has been obtained by radiographing

the teeth before and after movement, thereby proving development of bone, as the result of tooth movement, to be an entirely different process from what we had formerly thought. It was also proven by radiographs made by Dr. Ketcham that in the mesial and distal movement of permanent molars the teeth erupting posterior to the ones that had been moved succeeded in erupting in their proper position. As the result of radiographic studies made by Drs. Ottolengui, Kemple and others, it has been shown that a large number of permanent teeth are absorbed prior to, and in some instances, during orthodontic treatment. The causes of the absorption of the roots of teeth are not fully understood, and, if they are ever known, it will undoubtedly be through the aid of the radiograph. Another disputed question in the treatment of malocclusion is the change which occurs in the temporomandibular articulation during the treatment of mesioclusion and distoclusion. If this question is ever fully settled, it will be as a result of the knowledge gained through the radiograph.

It is the intention of the editor that the articles appearing in this department shall be instructive both to the beginner in radiography and to those who may no longer be classed as novices. With this end in view, articles of an elementary character will appear along with case histories, and other articles involving the practical application of the x-ray in the general practice of dentistry, in orthodontia, oral surgery, etc.

The man who enters dentistry today assumes a great responsibility and an obligation which is no less than that of the practitioner of medicine. Even though the field of our endeavors is limited, the teeth and their associated structures are now recognized as among the most important of the body from the standpoint of health maintenance. For years, scientific dentists have held that many serious bodily ailments were traceable to dental origin, but only within recent years has the full significance of their claims been appreciated by the medical profession and the public, in which pioneering work the x-ray has played an important role.

Only a short time ago one of the leaders in medical science made the statement that the next great step in preventative medicine would have to come from the dental profession. The question naturally arises, are we as a profession going to make good? If so, we must take advantage of every facility which will increase our efficiency among which the x-ray stands paramount.

The International Journal of Orthodontia

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ORIGINAL ARTICLES

DENTAL COLLEGES IN RELATION TO THE TEACHING AND PRACTICE OF ORTHODONTIA

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THE field presented by the title is very large, as may be readily seen upon a moment's reflection. It will not, therefore, be the purpose of the writer to discuss in the fullest details all that might be considered, and under such circumstances it should be recognized at the outset that a nicely connected logical discussion is well nigh impossible.

The subject to be discussed is of such wide scope that even a brief consideration will be lengthy—perhaps too lengthy for the vast majority of dental practitioners, for it is well known that most practitioners are more interested in short-cut, easy methods, leading to certain success, which all experienced, observing and conscientious orthodontists well know are not to be found in this branch of dentistry. Many of the features to be presented will therefore be brief—perhaps too brief to be sufficiently comprehended, or may even appear irrelevant.

There are certain questions relative to the practice of orthodontia, and the teaching of this subject in dental colleges, that well merit consideration, since there is some misconception regarding the relation of the one to the other.

Before attempting to discuss the question of education, we should first analyze the status of orthodontic practice and the requirements of service to the afflicted. In this way some light may be thrown upon the subject which will better enable us to reach a solution of the problem of education. For one to arise and declare more or less dogmatically, that this or that must not be done, or, that it must be done thus and so and not otherwise, simply because mistakes were sometimes made in the past when not done "thus and so," is not conclusive argument to sustain the declaration. Were the "thus and so" always perfectly

obvious, free from doubt as to ultimate success, free from other complications which might be even greater than the original affliction,—not simply in one or two respects, but in all respects; were there no material factors or circumstances involved in different cases entirely beyond the mere operative skill and technical understanding of the dentist or orthodontist; were there no differences of opinion among those who sit in authority, then the arguments might be considered closed, the case proved, and the verdict accepted without appeal. Unfortunately, however, this utopian state is not yet at hand, and what is even more unfortunate, the obstacles to be surmounted are such that it appears highly improbable that this state will soon be attained. While there are some problems in dentistry in which the course of treatment in certain respects is inflexibly established, from which there can be no deviation, it does not follow that such inflexibility can be applied to all of our problems.

Since orthodontia is practiced very largely as a specialty, some contend that the regular dental student should not devote any time to clinical work in this subject, because at best he cannot become sufficiently skilled to treat malocclusions of the teeth successfully in the general practice of dentistry, and that as a rule he does more harm than good when he attempts it. This is a somewhat sweeping charge, and in the opinion of the writer cannot be sustained if it is meant to convey the idea that the dentist of the future can do no better than the dentist of the past.

We may here inquire into the causes of the dentist's failure in the practice of orthodontia in the past, whereupon it will be found that there are many. First may be mentioned an inadequate conception of the evils of malocclusion. In the past the treatment of malocclusion has been looked upon more in the light of a luxury than a necessity, the principal evil having been considered the injury to appearance. While other evils were recognized, yet they were not generally considered serious. Even at the present time there is more or less diversity of opinion regarding the evils of malocclusion, one authority having recently stated that the most important reason for correcting malocclusion is that mastication may be properly performed.

Not until the general practitioner appreciates more fully the evils accompanying, or resulting from malocclusion, can he be expected to do his part with that vigor and intelligence which is so essential in the successful practice of orthodontia. There are too many dentists whose conception of orthodontic practice lies principally in finding some simple, easily applied and easily operated appliance that will insure successful results;—a will-o'-the-wisp for which the orthodontist is not entirely blameless.

Some of our orthodontists are interested in the manufacture and sale of regulating appliances, which may explain why we sometimes find enthusiasm over appliances and the ease with which results are obtained, carried to such extremes that the dentist is actually misled into believing that the correction of malocclusion is a simple matter if one has a good regulating appliance. One can hardly attend a dental meeting without finding exhibitions—by orthodontists—of wonderful appliances that make treatment of malocclusion a simple and easy matter. This undoubtedly has been largely responsible for the shortcomings—or failure if you please—of the dentist's work in orthodontia.

Instead of showing the dentist that orthodontia is very easy, it would be

far better to show him that it is very difficult, though not so difficult as to be entirely out of his reach. He should be brought to realize that this is a subject for continuous study and work, and cannot be successfully carried on by any process of mere rote or imitation; in this event he will first learn that he must begin his work under different auspices than has been customary.

We must constantly keep in mind, however, that the problem before us is an intricate one, which cannot be solved by considering any one point alone. Since there are many points, and scarcely one that is settled beyond reasonable debate, it will be seen that the issues must admit the personal equation, and consideration of possible exigencies of the case in hand, besides the patient's wishes. No absolutely inflexible law can be laid down to apply alike in all cases regardless of everything else. Again, we must not allow this sweeping generality to cover up ignorance,—gross ignorance, even though it is sometimes difficult to determine what constitutes ignorance, as may be seen "when doctors disagree."

All cases should be considered upon their individual merits, and when the dentist meets with cases where departure from well established principles seems to be indicated, he should avail himself of the counsel of an experienced orthodontist.

When the dentist believes, as most of them do, that the principal evils of malocclusion are injury to appearance, impairment of mastication, and danger of caries, he is not properly equipped for wise, vigorous, and efficient counsel, which in turn plays such an important part in the treatment of malocclusion, by enlisting that thorough cooperation of the patient, so essential to successful practice.

While these evils are potent and demand earnest consideration, they are not the worst, or most harmful features of malocclusion; this will be given further consideration hereafter. It may not at once be apparent just how consideration of the evils of malocclusion can have any material bearing upon the elimination of the bungling work or incompetency of the dentist, as is charged, in his attempts to treat malocclusion. As has already been indicated, there are many factors that enter into the problem under discussion; this is only one of them, but it is more important than might at first appear.

One of the very important factors entering into the successful practice of orthodontia, is that the way be properly paved in beginning the treatment. Unless the patient also appreciates fully the evils of malocclusion and the essentials underlying successful treatment, he will not be very likely to contribute full cooperation, and without this, success in the fullest measure can not be expected. Thus it falls upon the dentist to properly advise his patient regarding the evils of malocclusion, and what is essential in the treatment thereof, in order to get that full cooperation which is necessary for entire success.

It should be understood that full cooperation means more than merely keeping appointments, though this is frequently carelessly observed and gives rise to much trouble;—means more than allowing appliances to be placed upon the teeth, though this, too, is often interfered with, and, as the orthodontist knows, this is not conducive to success.

Full cooperation includes many features, among which necessarily is the important one of such reimbursement to the dentist that he need not feel that he is making sacrifices beyond his limitations in carrying on the treatment. Failure

in this feature alone is in no small measure responsible for the shortcomings of the dentist in treating malocclusion. It may not be amiss to state here that in all probability most of the deficiencies or faults found in the general practice of dentistry can actually be attributed to this cause, instead of ignorance as is commonly done. Good service in any branch of dentistry requires painstaking efforts and more time, in addition to skill and understanding.

Another cause of failure in the treatment of malocclusion by the dentist is due to the fact that treatment until quite recently was not well established, neither as to what ought to be done, nor the means by which it might be accomplished. Not only were there no well established principles of practice in the past, but even now we find differences of opinion among those whose opinions are entitled to consideration, differences upon important points. Some of our leading specialists might also concede that not all of their work has proven entirely successful.

If the contentions here set forth are admitted, then it must be readily seen that the culpability of the dentist, as has been charged, is not without some extenuating circumstances, and he should not, therefore, be immediately decapitated, at least not without some further careful consideration.

Before proceeding further, it may well be asked here what are the specific charges against the dentist's practice of orthodontia? In general it is held that he does not correct malocclusion, and therefore his work is a failure. It is also claimed that the dentist extracts teeth in attempting to correct malocclusion, thus, on the whole, it is maintained that he does more harm than good.

If by failure is meant that the dentist does not obtain ideal results, the charge is undoubtedly justified in many cases. But this, however, cannot be interpreted that the orthodontist would secure ideal results in all cases, unless it is assumed that the orthodontist would not undertake treatment where, for any reason whatever, ideal results could not be obtained. This raises a very serious question upon which even specialists are at variance. To obtain ideal results in the treatment of all cases of malocclusion, frequently involves great difficulties, in which the patient for various reasons cannot fully perform his part, and in addition, there is the danger that serious consequences may follow in many cases where teeth must be restored by bridge-work, whereby pulp devitalization may ensue in the attempt to establish ideal occlusion.

Until it is thoroughly established that the treatment of malocclusion should never be undertaken unless ideal results are obtained, the charge against the dentist upon this ground is not sustained. Moreover, the establishment of ideal occlusion does not guarantee permanency of results, the claim of certain specialists to the contrary notwithstanding, and permanency of results must always be the ultimate measure of success.

In discussing these problems, it can avail but little if the considerations are limited to only favorable types of malocclusion in which ideal results are readily obtainable.

Until we have a higher standard of education, not only of the dentist, but of the public as well, there will be many cases of malocclusion which will present more than ordinary difficulties, owing to neglect of the teeth, both temporary and permanent, and frequently to extraction.

The public should be taught to understand and appreciate good dental serv-

ice, though this alone will not be sufficient. The education of the public must include the great problems of economics. Society as organized at present does not permit more than a favored few obtaining the best that can be done in all that is essential to human welfare. Only a small percentage of our population—estimated at about twelve per cent—at present receive dental treatment other than extraction and artificial dentures.

Regarding the extraction of teeth as a corrective measure, it must be admitted that harm has been done, but it should be observed that this is an evil confined very largely to the past, when the principles of practice were not as well established as they are now. It is very doubtful whether this charge will be preferred against the younger generation of dental practitioners whose college training has been what it should be; not, however, that there will never be found a case where ignorance or bad judgment has been shown, for not until the great millennium is reached in which no evil, pain or unhappiness is found, may we expect this. The prudent dentist of little experience will seek counsel before he decides upon extraction. The question of extraction in mutilated cases, which are frequently found,—cases having previously suffered extraction—is by no means one of a single idea. In this connection it may be stated that it is quite within the range of possibility that the nonextracting orthodontist has done even greater harm in his zeal to obtain ideal occlusion in cases where teeth were missing, by resorting to bridge-work and thereby causing devitalization of pulps. As is generally well known the devitalization of pulps is now regarded as a much more serious matter than it has been in the past.

We may now inquire whether it is desirable or necessary for the dentist to treat malocclusion of the teeth, in view of the fact that the successful practice of this branch of dentistry presents many difficulties for any other than the specially trained orthodontist. It must be admitted that the treatment of malocclusion of the teeth considered in its entirety, with the multitudinous complications that may be encountered, demands great skill and understanding, which unquestionably cannot be attained to the fullest extent by the general practitioner of dentistry under ordinary circumstances.

Since malocclusion needs treatment, however, wherever it may be found, and as specialists cannot be located in every community that will support only one or two dentists, it is clearly evident that many who are afflicted with malocclusion must be denied treatment if the local dentist does not practice orthodontia. Only the large cities afford a field for the orthodontist, and as more than one-half of our population lives outside of the large cities, it is obvious that many could not receive treatment if the dentist does not give it. This, it appears, shows conclusively that the dentist must practice orthodontia. Could malocclusion be treated similarly to the removal of adenoids, then it might be maintained, for reasons that are obvious, that none other than the specialist should attempt the treatment.

There now remains to be considered whether the dentist can become sufficiently proficient in this branch of dentistry to enable him to practice it with reasonable assurances of success. It has been admitted that the dentist of the past has not done as well as he should, in fact, has done harm in some instances. It has also been shown in part why he has failed. To pursue this investigation further, it should be borne in mind as was heretofore indicated, that there are

many causes for his failures; that the channels through which they operate are diverse and some very indirect, so that potent causes may be lost to view. Only by seriously and serenely viewing all of the evidence, pro and con, with an earnest desire to know the whole truth, may we hope to find the true perspective. Many of our problems throughout dentistry are viewed from too narrow a standpoint, even by those often-times who are competent to speak with authority.

In the light of our present knowledge and understanding, it is not easy to appreciate fully the difficulties of the past regarding the practice of orthodontia by the dentist, owing to the chaotic condition of the principles and the practice that have existed. And when we stop to consider that at the present time there are some so-called specialists,—who meet the popular requirements of the term, namely, devoting their entire time to this branch of dentistry—that are practicing orthodontia with little or no regard whatever for correct occlusion of the teeth, it is not at all strange that the dentist's work in orthodontia is subjected to criticism. Obviously, the situation will not be clarified by turning this branch of dentistry over to the specialists as we find them today.

To return now to the inquiry as to why the dentist has not succeeded in the practice of orthodontia, we will refer again to the lack of appreciation of the evils of malocclusion which in turn brings up his education. The dentist has been educated to believe that the greatest evils of malocclusion are injury to appearance, impairment of mastication, and danger of caries. This is not only wholly insufficient to impress patients in many instances with what is actually necessary for successful treatment, but the dentist himself is not equipped for successful practice if he does not realize that there are greater evils. Anything that is injurious to the patient must be fully appreciated by him before he will seek and receive treatment; or in other words, before a patient will submit to treatment, especially if it involves him greatly, such as pain, inconvenience, great expense, many visits, long period of treatment, etc., he must realize fully the evil of his affliction, otherwise he will decline treatment or seek only that which appeals to him. With only partial appreciation of the evil and what is essential to treatment, the patient will frequently strive to obtain only such treatment as appears reasonable to him, and this with the faulty understanding of the dentist, naturally spells failure.

Injury to the appearance is generally the principal one in which the patient feels concerned, and this is usually observed only when the upper anterior teeth are noticeably malposed, consequently he requests correction of only that which he sees, and when the dentist with his limited knowledge attempts to comply with the request, the result is usually failure. Malocclusion that does not mar appearances noticeably will usually go unheeded by the patient, unless convincing argument is presented to him showing that there are other very important reasons for treatment.

Impairment of mastication will rarely appeal to the patient as a sufficient cause for treatment, unless very pronounced malocclusion is present, in which it may be readily seen that injury to digestion and nutrition may follow. Furthermore, excepting very marked malocclusion, the dentist himself in all probability has little faith that mastication is often impaired to such an extent as to actually injure digestion and nutrition. That mastication is frequently not prop-

erly performed is admitted by all, but this is oftener due to bad habits or haste rather than a perceptibly defective masticatory apparatus.

As to the danger of caries it may also be said that it does not always accompany malocclusion, though it must be admitted that caries is favored by malocclusion; this of course will depend somewhat upon the character of the malocclusion. All have seen cases of faulty proximate contacts due to malocclusion and yet no caries was found up to thirty, forty or even fifty years of age, while in other cases where the proximate contacts are normal, caries is often found in early youth. The writer does not mean to imply hereby that malocclusion does not favor caries, but there are other causes of caries that are much more cogent. with reference to which there is need for much more concern than is now shown by either dentist or patient.

It is not the intention of the writer to minimize in the least the evils of malocclusion as mentioned, but there are greater evils that should be better recognized and emphasized in order that both dentist and patient may more fully appreciate the necessity for correcting malocclusion, and that the term "correcting malocclusion" may be interpreted with greater exactness so that reasonable assurance of full success may be expected.

Only in this way will there be probability of such cooperation as is essential, and that nothing will be left undone which is necessary for success. Attention may again be directed, however, that at no time can we lose sight of the fact, as already stated, that even when the fullest correction of malocclusion has been made, the good results obtained may not be permanent in every case. Even those who have had much experience in the treatment of malocclusion will acknowledge—very reluctantly sometimes—that results obtained at the time of completion of treatment are not always permanent.

Greater evils of malocclusion are, injury to the attachments of the teeth, and injury to the positions of other teeth, or in other words as regards the latter, malocclusion begets malocclusion—malocclusion becomes intensified.

These evils are not new or hitherto unknown. They have long been known, but they have not been sufficiently appreciated by the dentist, in consequence of which patients have not been earnestly and well advised.

Injury to the attachment of the teeth as a result of malocclusion is finding recognition in some other respects in the practice of dentistry. Dr. Forrest H. Orton, the well-known authority upon crown and bridge-work, has recently stated that he considers occlusion the most important feature of that branch of dentistry. This is a most remarkable statement, in view of the fact that Orton has arraigned that branch of dentistry more severely than any other exponent, upon the grounds of faulty root preparation and faulty contours of crowns, though now he holds that faulty occlusion is the greatest evil. By faulty occlution, Orton means particularly malocclusion, which results in injury to the attachment of the teeth involved. Talbot many years ago directed attention to the injury being done to the attachment of the teeth and alveolar process by crown and bridge-work. Case also showed several years ago that the treatment of pyorrhea is aided by correcting malocclusion. Bonwill in his days of enthusiasm over his anatomical articulator said that he "cured pyorrhea with his articulator," which of course elicited laughter, but those who knew Bonwill were well aware that it was not for mirth that the statement was made, for he

was an earnest, energetic worker whose experience and observation had proven to him the truth of his statement.

If the attachment of the teeth is injured by malocclusion, as has been noted by many careful observers, and gives rise eventually to pyorrhea, it seems needless to dwell upon this, for the seriousness of this disease is now well known. Surely nothing associated with malocclusion can be worse than the ultimate loss of the teeth by pyorrhea, which in turn is now also quite generally believed to be frequently responsible for serious systemic disease. Pyorrhea specialists recognize the futility of their treatment when malocclusion is present, without correcting the malocclusion.

That malocclusion begets malocclusion is an axiomatic truth that stands in marked contradistinction to "nature correcting malocclusion." Who can estimate the harm that has been done and the increased difficulties that have resulted from the advice "wait and see what nature will do"? During the developmental stage it is sometimes observed that nature assists somewhat in diminishing malocclusion, but this has been proven in many cases to be a dangerous precept. Sometimes a malocclusion appears insignificant or may even escape detection by the general practitioner, and later it gives rise to quite pronounced irregularity, as every orthodontist who has had much experience and has been a careful observer can testify. Even patients sometimes observe that unsightly malocclusion has appeared in their mouths after the age of youth when—as they supposed—there was no malocclusion before. Dentists have shown their ignorance by questioning such statements, believing that the patient had simply failed to notice the irregularity before. True in such cases malocclusion was present earlier in life, but it was not of such form as to attract attention; as time proceeded, however, it increased until finally it did attract attention.

The most lamentable feature of this is that the dentist also has failed so often to notice malocclusion in earlier life. Too many dentists do not notice or recognize malocclusion any better than their patients. In fact, I have known in numerous instances that the patient first discovered malocclusion in his mouth and then brought it to the attention of the dentist; this has occurred in cases where the patient has been regularly under the care of the dentist.

In view of these observations, it seems strange that orthodontists and dentists have not attached greater significance to these evils, for their importance appears to be self-evident, and since the dentist depends upon the orthodontist for all that is essential to the successful practice of orthodontia, it must be admitted that he is not altogether to blame for his shortcomings in the treatment of malocclusion of the teeth.

It is the writer's firm conviction, that upon careful analysis it will be found that failure in appreciating more fully these evils, has in a large measure been responsible for the most frequent shortcomings of orthodontic practice by the dentist, both directly and indirectly. If the dentist appreciated more fully these evils he would make more strenuous efforts to have his patients understand and appreciate them also, whereupon they would be more likely to heed the advice given them and make greater efforts to lend their full cooperation, which in turn would tend to greater success. In such event the dentist would not consider short-cut or makeshift treatment, and if the patient had better understanding he would be far less likely to request or insist upon such treatment.

However, as was previously noted, the poor results seen in the treatment of malocclusion by the dentist are not always due entirely to ignorance on the part of the dentist or lack of understanding and appreciation on the part of the patient. It is that unfortunate state of society which renders so many people unable to procure the best dental services owing to financial limitations, that is in a large measure responsible for the poor services rendered, not alone in orthodontia but in all branches of dentistry. I am well aware that this phase of the problem when presented for consideration is frequently decried, even treated with scorn and contempt by some who have either never had this to contend with, or they have long since found more lucrative fields and have forgotten about it. Nevertheless, the problem is a real one, and it is serious. It cannot be disposed of as some are wont to do, by a mere wave of the hand with an air of superiority, and simply crying out to "prepare"—and "qualify;" and "give"—"give the best there is in you;" "that he who is well qualified will never have any difficulty in obtaining compensation proportionate to his worth," etc. He who refuses to recognize this unfortunate state of affairs need not be expected to render material aid in overcoming one of the greatest obstacles to the performance of the best services throughout the entire field of dental practice. It can safely be said without fear of successful contradiction, that not until this obstacle is overcome can we expect the best to always be done in any branch of dentistry, but particularly in orthodontia in which the sacrifices called for on the part of the dentist would frequently be so great that he must either decline to render any service whatever, when the fee obtainable is wholly inadequate for the best service, or yield to the temptation of trying to relieve his patient as best he can, for such compensation as he may be able to obtain, and thereby subject himself to the criticisms of the idealist.

When the dentist attempts to treat a case of malocclusion for $50.00—even this is a prohibitive fee for many patients—for which the orthodontist under very conservative consideration would require at least five times as much, it may readily be seen that someone must suffer. The dentist may bear such a burden once or twice before he decides that it is not a part of his duty to carry so much of his patient's misfortune, when he will conclude—and not without justification—either to refuse treatment entirely, or compromise and do the best he can for the pittance obtainable.

The importance of fees and the business side in general, in connection with the practice of orthodontia, is recognized by at least one of our educational institutions, where it is treated as a special branch of education under the head of economics.

The effect of this cannot be otherwise than wholesome, and it would be well if similar education were given in all dental colleges regarding all branches of dentistry, for, as previously indicated, it will be seen—eventually if not now—that a very large portion of the poor dentistry found, is directly due to low fees, which in turn is at least partly due—directly or indirectly—to a misguided spirit of philanthropy shown here and there by some of our prominent men as representing true professional spirit.

Dentistry of higher grade cannot be expected without compensatory fees. Higher education of the dentist alone will not insure higher quality of dental practice, for, as already indicated and as is generally well known, superior work

of any kind requires more time and time represents the dentist's earning power. The dentist does not seek riches as a rule, but even if he did, it is well known that there are exceedingly few who have amassed wealth in the practice of dentistry, assuming that by wealth is meant something beyond a modest home and such things as are necessary for a respectable living,—surely no one should deny the dentist such possessions.

In trying to imitate the medical profession, by which we are often well swayed, we must be very careful of our premises when making comparisons. The highly educated medical man requires no more time to write his prescription than does the one of lesser learning; the highly trained surgeon requires no more time to perform an operation than does he who has not been so well educated. Not so in dentistry, however, where as we well know, the better service requires greater technic and more painstaking which means more time—vastly more time. Were the difference in time between the best service and that which is poor, only a few minutes, then there could be no defense for the poor service; but when the difference in time is measured by hours, it becomes a matter of serious consideration. Even in so simple a service as cleaning teeth—which by the way is not such a simple matter as many patients have been led to believe, especially in cases where the teeth have not been previously well cared for by both patient and dentist—the time required may be several hours and necessitate several visits, yet ordinarily it is regarded as "simply cleaning teeth." A sermon upon this alone, or several of them since one will not accomplish much, is urgently needed by both the public and the dentist. Every thoughtful and carefully observing dentist well knows that this is a very important service, and he knows too that it is one of the most common, shabbily performed services rendered by the practitioner, yet we rarely hear a real plaintive note as is heard about other features of dental practice. Can anyone compute—in the light of our present understanding of the evils of pyorrhea—the amount of injury suffered by our patients because of the carelessness shown in this "simply cleaning teeth?" The two principal causes of this are first, lack of appreciation on the part of the public that the teeth are really of vital importance in the general economy, believing as they do that they do not involve life and death. In consequence of this comes the second cause in that the dentist finds it difficult to obtain proper remuneration for the best service in cleaning the teeth, and so frequently too he finds that the patient does not cooperate by doing his part in caring for his teeth; the well-known result naturally follows therefore.

To remedy this, as well as many other defects of dentistry, a campaign of public education is necessary, for it cannot be accomplished by the dentist individually. This is a matter to be taken up in good earnest by our dental societies.

It is highly important that the public be educated regarding dentistry in general, in which orthodontia should be included. An educational campaign should be carried on to overcome the evil influence exerted by the deception, and the misleading information placed before the public daily, by charlatans using the daily press. The pernicious effect of this baneful influence is greater and farther reaching than is generally realized, and is not confined to the locality where such publication appears. Many young practitioners are gradually led to lower standards of dental practice, frequently more or less unconsciously, because this evil influence is so great that they cannot escape it entirely;—operations and

treatments are hurried along because the dentist keenly feels that he cannot afford to spend the time necessary for perfect work for the fee he can get. While there are many causes for the low standard of fees, the one here mentioned is undoubtedly the most potent.

There are of course a few practitioners who do not suffer appreciably from these causes, consequently they are not as a rule competent to speak upon this point, though not infrequently they essay to do so. Upon careful examination, however, it will be found that a very large percentage of dental practitioners do so suffer, or rather would suffer, if they did not throw the burden upon their patients. Thus, in the end it is the patient that is the sufferer, and, therefore, it is the public that needs education even more than the dentist, since education of the dentist alone cannot possibly overcome this difficulty, unless some means is found whereby perfect services may be rendered in very much shorter time than is now possible.

The writer is not unmindful of the fact that there are some practitioners who receive ample fees, yet render poor service, but it is not intended to discuss here all the evils of practice and attempt to prescribe remedies therefor. It is only because we find so frequently, that the poor dentistry so often seen, is attributed to poor education of the dentist—which undoubtedly is not infrequently the case—that this question is brought into the discussion. Upon careful analysis it will become perfectly obvious that there are other potent causes for poor dentistry than simply faulty education of the dentist.

It may not be amiss here to allude to those phenomenal practitioners to whom anything less than perfect operations or perfect treatments in all cases is apparently unknown, and who therefore would have it appear that every practitioner should and may do likewise. Even if it be admitted that there are some practitioners who are so far superior to others that perfection marks every service they render, there probably will be found no others who are willing to say that all may reach such lofty heights. And when such heights are not reached, who shall say, and what shall be the standard of measure as to the shortcomings allowable? It is said that "one extreme is as bad as another," and this may not be altogether inapplicable here, though of course all will agree that all efforts should be bent towards perfection, but, to attain this, however, we cannot fail to take cognizance of every factor that militates against such end.

When it is recalled that for many years now, not only must the dentist have had college training, but he must also pass inspection by state examining boards as to his qualifications (here the writer hears "no stream can rise higher than its source," but upon more than one occasion such crier's own work has been known not to warrant turning on the searchlight), and since he cannot practice dentistry without having demonstrated his proficiency, it ought to be very strong evidence that there is something besides faulty training of the dentist that is responsible for poor dentistry; yet the cry continues, "poor dental training." Not that the writer is content with present dental training, for he will yield to no one a keener appreciation of the need for better education—and in this connection the question might well be asked, what constitutes better preparation of the dentist?—but it is so evident that there are greater causes for poor dentistry than present education of the dentist alone, which if not recognized and corrected will

result in a continuation of faulty dental practice even though dental education be increased to four years as is now taking place.

If there were nothing other than poor dental training that is responsible for the poor dental practice so frequently seen, it should be self-evident that the practitioner must either improve or retire, for the law of survival may safely be presumed to operate here as elsewhere. Many well know that it is the unfit—judging by the work done—that frequently survives longest in dental practice. Moreover, it may be frequently observed that the dentist not only does not improve but actually fails to do as well as he did in college or as well as he demonstrated to the examining board, simply because he finds that the public does not appreciate fully what the best in dentistry implies upon its part, and that it is exceedingly difficult, often utterly hopeless, to develop such appreciation and understanding. This lack of appreciation, however, is, as elsewhere noted, undoubtedly due in many instances to economic reasons over which many have little or no control.

To educate the public individually by the dentist, as is often advised by some who assume to speak with authority, is exceedingly slow, inefficient, and expensive to the dentist, as many can testify who know from experience. Who among earnest practitioners of considerable experience has not found time and time again, after spending much valuable time advising patients in one particular or another, that it is not comprehended, or appreciated; that ulterior motives are interpreted, or that the whole is promptly forgotten.

It is the writer's firm conviction that one of the most important steps in the advancement of dental practice will be found in education of the public, whereby the people may be enabled to understand and appreciate the difference between good and poor dental service. Another obstacle in this connection is that at the present time there are entirely too many people whose chief concern regarding their teeth seems to be limited to pride and convenience, who seem to feel that that scriptural injunction about plucking out the offending eye may be applied with impunity to the teeth. But in the light of recent developments regarding bodily welfare as related to pathologic conditions of the mouth, it is highly probable that people will feel more concern about their teeth in the near future especially if they are properly enlightened.

If an object lesson is needed regarding the efficiency of public education, it may be found in the rapidity with which the public became informed and interested—whether with material benefit or not is another question—in the emetine treatment for pyorrhea. I dare say that some people learned of this before their dentist did.

With the awakening of the medical profession regarding the possibilities of disease of the teeth and mouth and the treatment thereof along with an efficient campaign of public education, we may accept as a foregone conclusion that the public will promptly become more discriminating in seeking dental services, and then may we hope to see the standards of dental practice rise, which will be further assisted by better education of the dentist as a result of increased time and greater intensity of purpose.

In summarizing, it appears conclusive that the dentist should practice orthodontia, and therefore his education must prepare him as well as possible. While education in this branch of dentistry has been inadequate as conducted

in dental colleges in the past, the same may be said of other branches of dentistry. It is for these reasons that the dental course has been extended to four years which will therefore permit better preparation in all branches in the future.

Education in orthodontia, however, has not been as good in the past as it might have been, due to various reasons;—first, the student was not sufficiently impressed with the importance of the subject—the evils of malocclusion and the necessity for treatment—in consequence of which he did not feel sufficiently interested to avail himself to the fullest extent of such educational opportunities as were presented. It was not uncommon for students to remark that they did not care for orthodontia—that they did not intend to practice it—that people were not sufficiently interested to have the work done—that they would send their cases to a specialist—that all they cared for was to pass the chair, etc. Second, for many years there were no well established principles of practice, and even now there are differences of opinion regarding fundamentals, consquently it was impossible for the teacher to lay out a definite, tangible, well connected course whereby the student could gain a working knowledge sufficient as a foundation to build upon; under such conditions too it was with difficulty that a student's interest could be aroused. Furthermore, the teacher also recognized that the student lacked interest, and that there was insufficient time for proper training, besides the probability that there would be little call for this work in the young dentist's practice, therefore he too lacked enthusiasm and carried on his work in a more or less perfunctory manner. Then, too, the public in the past knew very little of the possibilities or needs of treatment of malocclusion, and for many years injury to appearance was regarded the principal evil; if the patient did not ask for treatment the dentist usually did not suggest it.

Thus it may readily be seen why the practice of orthodontia by dentists educated several years ago, among which may be included some of comparatively recent education, is the object of criticism at the present time; in addition, the dentist is now censurable for sins of omission as well as those of commission, as is found in his frequent failure to promptly recognize malocclusion in its incipiency, when under proper advice and treatment it might be avoided or greatly mitigated.

There has been marked advancement in the theory and practice of orthodontia, and the public has also been educated somewhat to know something of the possibilities and the necessities of treatment in this branch of dentistry, thus the conditions for education and practice are more favorable than they were in the past. There are, as previously shown, some deficiencies and some obstacles yet to be overcome before this branch of dentistry can occupy its place in general practice without much criticism; but as already shown, there is no branch of dentistry that is not subjected to more or less criticism in general practice.

With a greater appreciation of the evils of malocclusion, and the causes that produce it, observing that these are much further reaching than has been properly recognized in the past, this subject becomes one of the most important in dentistry.

Pyorrhea or one of its incipient stages, one of the most common diseases of the mouth, is generally admitted to be invariably found sooner or later in malocclusion of the teeth, and in such cases the treatment of pyorrhea will not be successful without correction of the malocclusion.

In crown and bridgework we are told that faulty articulation, which, as previously shown means malocclusion, is the greatest evil in that field.

It has also been shown that malocclusion, which might hardly be noticed in youth, tends to intensification.

The dentist therefore expecting to reach the highest standards in the ordinary interpretation of the term dentistry, must of necessity be well informed and appreciate fully the subject of orthodontia. Orthodontia is no longer a mere luxury or an adjunct of vanity.

With a proper presentation of this subject to the student so that he may fully appreciate its importance, his indifference of the past will give way to the keenest interest, in which case it will be found that even under the present length of time he can acquire a much better understanding and working knowledge of the subject than he has done in the past. And with the addition of another year which is about to go into effect in the course of most dental colleges, the student should become sufficiently well grounded that he may treat malocclusion with a reasonable measure of success. The student should be taught that in difficult cases it will be well for him to seek counsel until his experience has been such that he may rely upon his own understanding. The young dentist should understand and feel that in no case is it a reflection or discredit to seek counsel from an experienced orthodontist when he meets with a case that is not entirely clear to him; on the contrary, it should be distinctly to his credit and inspire confidence in his patient.

This is not to say, however, that all dentists should treat malocclusion, for those who practice in the larger cities where orthodontists are available. may if they wish refer their cases of malocclusion to the specialist, which undoubtedly it will as a rule be well for them to do. Yet, for the dentist's education, a thorough course in orthodontia should not be omitted since he has a very important function to perform in general practice which may be spoken of as preventive orthodontia. With only partial training in orthodontia without intention to practice, there is great danger of the dentist not appreciating the subject sufficiently to insure that careful observation of children's teeth necessary to avoid the production of malocclusion, or to promptly recognize it and refer the case. Every orthodontist knows only too well that many cases of malocclusion might have been avoided or mitigated had the teeth been properly cared for from early childhood, or where malocclusion was inevitable had it been promptly recognized and the case taken in hand for treatment. In other words, the dentist frequently fails to observe malocclusion in its incipiency, and occasionally fails to notice quite pronounced malocclusion when it already exists and should easily be seen.

In conclusion it may be said that it appears clearly evident that the dental student, instead of having his education in orthodontia curtailed in any respect whatever, should have it extended, in order to prepare him not only for the practice of orthodontia where it is required and specialists are not available, but for the better practice of dentistry as well. Unless the student's training includes clinical work—which some who speak with authority say should be omitted because they believe that the dentist should not try to treat malocclusion—with a view to practicing orthodontia, he can scarcely be expected to feel and exercise that deep interest and keen foresight so essential to the best practice of general dentistry, particularly as regards the care of children's teeth in relation to

malocclusion; nor will he be likely to give vigorous and efficient counsel to his patients so that they may appreciate and heed his advice. And, as was shown, there will be many cases that cannot be sent to a specialist, consequently the dentist should be prepared to treat malocclusion.

With better appreciation of the evils of malocclusion, better appreciation of the necessity for treatment, better establishment of principles of practice, better understanding of the elements of successful practice, better education of the dentist as a result of deeper interest and extension of time, and better education of the public, there is good reason to believe that the general practitioner may become sufficiently well prepared to begin the practice of orthodontia and render services that will be beneficial to his patients, even though ideal results may not be obtained in every case.

Operating Room Illumination

VARIOUS medical journals have been discussing the question of the desirability of getting away from having everything white in operating rooms. Several surgeons have been experimenting with different colors, and one surgeon has gone so far as to have everything in black, even to the sheets and operating gowns. We are disposed to believe that it is a good plan to get away from the pure white, which is tiring to the eyes, and especially to do away with glazed surfaces which are very objectionable through reflection. Still it is quite unnecessary to go to the extreme and adopt black, which makes it necessary to increase the amount of artificial light in order to illuminate the field of operation as well as the surroundings; and we cannot quite agree that green, though restful to the eyes, is very much more desirable. There are, however, some of the soft shades of gray which are restful to the eyes, while at the same time giving an appearance of cleanliness and interfering but little with illumination. An operating room with walls, ceiling and floor in a soft tint of gray, and in the flat or dull finish so as to avoid reflection, makes an ideal color scheme which does not tire the eyes, and is all that could be desired from an esthetic point of view. If the surgeon desires to carry this still further he can have his gowns and coverings for the patient and tables in gray tints, though that is quite unnecessary.

Furthermore, it should be remembered that the question of illumination has much to do with comfort for the eyes of those who are obliged to be in operating rooms for any considerable length of time. Too much illumination is just as bad as too little illumination. The tendency to have an operating room lighted on two or more sides in addition to having a skylight, may prove objectionable if there is considerable sunlight or considerable reflection. The softest light is that from a northern exposure, and when it comes to artificial illumination, the powerful light from numerous high-power tungsten lamps is quite sufficient to tire even the strongest eyes. Theoretically, it is far better to have less light and have it properly directed and subdued than to be annoyed by the discomforts from undue brilliancy. In fact all of our ideas concerning illumination are undergoing a change and our efforts to secure uniform and sufficient illumination in our offices and residences by using indirect illumination are beginning to be used in operating rooms, and with no little success. Brilliancy of illumination does not mean possibilities for better work, and it does mean discomfort for the operator.—*Journal of the Indiana State Medical Association.*

THE EVOLUTION OF THE PRINCIPLES OF JACKSON APPLIANCES

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PART III.

Construction of Removable Jackson Appliances

PREPARATION OF MODELS.

INASMUCH as Jackson appliances are made over models by a process of offhand construction and assembling of the parts, the casts should be perfect, and the greatest care should be given to preserving the anatomical outlines over which the parts are made.

The best assurance of perfect-fitting appliances is the use of models made only from plaster impressions. The model material should be the finest grade

Fig. 7.

of plaster of paris. If any of the very hard compositions of modeling material are used, or if the plaster of paris is boiled in stearine or paraffin, the possibility of exercising correct technic is lost.

Models should not only be made of plain plaster, but must be used moist. When the numerous parts are made over dry plaster surfaces, they have to be removed, set aside, and assembled when all parts are finished. By this plan the desired accuracy is lost because the construction is a progressive process of building one part upon another, from the first to the last, and if the parts first made are removed, it is impossible to make allowances for the subsequent parts

Fig. 8.

Fig. 9.

to fit over them accurately. If the model plaster is moistened, the individual parts have sufficient adherence to remain in position, allowing the advanced steps to be taken with accurate calculation of size.

CARVING MODELS.

After the design of appliance has been determined, the next step is the carving of the cervical borders of the posterior teeth selected to bear the "partial clasps" lingually and the "spring clasps" buccally. Dr. Jackson has always emphasized this point, for the security of anchorage depends on the use of the cervical constrictions.

Along the linguo-cervical borders of all posterior teeth which are to bear "partial clasps" a very thin, sharp-pointed instrument should be drawn to make a narrow groove to represent the natural space between the cervix and the gingival border of the free margin of the gum. This instrument should be inserted at an angle of approximately 35 degrees from the axis of the tooth to carve out the groove anatomically correctly (Fig. 7).

The bucco-cervical borders of teeth to bear spring clasps must be brought out clearly by trimming away the slightest possible amount of the outlines of the free margins of the gums. To do this, the instrument should approach the surface at right angles from the axis of the tooth (Fig. 8). The surplus left between this line and the buccal surface can be carved away, thus opening a distinct outline of the bucco-cervical border to which to fit the clasp (Fig. 9).

PARTIAL CLASPS.

The next step is the construction of "partial clasps." "Partial clasps" are made of partial clasp gold, a material specially prepared by Dr. Jackson for this purpose. It is a stiff 36-gauge plate metal, possessing a specially treated surface on one side for a very tenacious adhesion with the tin solder, and a pure gold surface for contact against the teeth. This material will respond to the contouring plier without annealing, but it is made specially hard to prevent the borders from curling out of the cervical constrictions under the operation of insertion and withdrawal.

The success of attachment depends greatly on the adaptation of the partial clasps into the linguo-cervical constrictions of the anchor teeth, held in position by the spring clasps buccally. As these borders glide over the convex lingual surfaces during removal and insertion, they would be bent outward if made of soft material, causing the apparatus to loosen. This strain will also cause a weak solder connection to loosen, so that the partial clasps will scale off, leaving only a solder surface in loose contact with the tooth. For these two principal reasons this material has no substitute, and, being the first step in the construction, failure here results in complete failure of the appliance.

Partial clasps are to be fitted to all the posterior teeth engaged in the arms of the appliances for anchorage. They must be fitted with perfect accuracy well into the cervical constrictions, slightly beneath the free marginal outlines of the gums. The ends of the partial clasps should extend to the mesial and distal aspects of the lingual surfaces, but not into the proximal surfaces. If these ends project too far interproximally, they prevent the appliance from seating, wedge the teeth, and cause painful injury to the interproximal tissue.

Partial clasps should extend toward the lingual cusps, slightly occlusally to the point of greatest curve of the lingual surfaces, but not far enough to interfere with the occlusion (Fig. 10).

The treated surface of the metal must be faced outward, with the pure gold surface touching the model, and this specially treated surface can be readily distinguished by its color and finish. A wider strip should always be cut for the molars than for the premolars in order to keep the occlusal borders on a straight line mesio-distally.

Fig. 10.

Fig. 11.

Fig. 12.

The contouring plier (Fig. 11) will conform the strips to the double curve of the lingual surface to any desired length. After trimming the cervical border to fit perfectly, the partial clasp should be carried to place, with the curve of the plate smaller than the curve of the lingual surface of the tooth, and it can then be enlarged by pressing it to position, where it will remain securely (Fig. 12).

SPRING CLASPS.

Spring clasps are divided into two forms—full and partial. The full spring clasp entirely encircles the tooth, crossing from the lingual to the bucco-cervical

constrictions over the interproximo-occlusal grooves, with both ends attached in the solder. This design is typical of the removable appliance.

The partial spring clasp only partially encircles the tooth, crossing over only the mesial or the distal interproximo-occlusal groove, traversing the bucco-cervical constriction, terminating at the opposite proximal side whence it crossed for attachment lingually. This clasp is used both in the fixed-removable and the removable types. Two spring clasps are employed on both sides of the arch

Fig. 13.

Fig. 14.

to secure balance of attachment, and are usually placed on the most anterior and most distal teeth engaged in the arms of the appliance.

Spring clasps are made of 21-gauge and 20-gauge special alloy nickel silver wire. Number 21 gauge is generally indicated in all partial spring clasps and also in the full spring clasps, excepting for specially large teeth. The wire should be cut into between two- and three-inch lengths, and the bending begun in the middle to permit of free holding for bending until the clasp is complete. The clasp wire should first be bent to the curve of the gum scallop on the buccal surface, with the two ends pointing occlusally to the proximal sides.

After this the second step is to bend this bucco-cervical portion into a second curve, the curve of the bucco-cervical constriction, mesio-distally. For this it is necessary to use the brace of a rubber block to control the bending accurately (Fig. 13).

The third bend requires the greatest accuracy because it forms the angle between the buccal and occlusal surfaces. If this bend is too high, it causes the occlusal portion to interfere in occlusion; if it is bent too low, the bucco-cervical region will be too short on the teeth to reach the cervical constriction. To grasp the wire accurately, the operator should possess a medium-length left thumb nail, so it can make the grasp accurately (Fig. 14), bringing off the wire so the end of the round-nosed plier can pick up the exact point by running it down over

Fig. 15.

Fig. 16.

the surface of the thumb nail (Fig. 15). It is far better to continually underbend, trying to position frequently, and in this way continue progressively. By bending too far, the work has to be undone, started over again, and usually the part is ruined by inaccuracy and breakage by crystallizing the wire.

In making full spring clasps, the mesial and distal portions should be carried across the occlusal surfaces together, for, if one side is finished first, the clasp is liable to be warped. After fitting across the occlusal surfaces, the ends are bent downward, to be curved around midway of the partial clasps for soldering. The mesial end should be bent to traverse the entire length of the partial

clasp distally and *vice versa,* so as to gain a strong mechanical attachment in the solder. If these ends are cut short, they may pull out of the tin, which is caused by a mild galvanic corrosion which gradually makes ingress between the wire and the tin, loosening the adhesion a short length around the wire at the point of entrance into the tin, causing a short straight end to pull out.

It is also important to extend the ends of the spring clasp wires to rest against all partial clasps not engaged (Fig. 16). If this is not done, the attraction of the molten tin as it is drawn over the partial clasps on the soldering iron is liable to pull them off or displace them slightly.

After finishing the partial clasps and the spring clasps, the anchorage or "arms" are completed. It is best to unite the number of small parts at this juncture, reducing to one unit on each side the five to ten small parts which are very important to preserve accurately, and which are liable to displacement during the advanced steps.

The weight of the soldering iron against the lingual ends of the clasps is liable to elevate the bucco-cervical portions, where the greatest accuracy is re-

Fig. 17.

Fig. 18.

quired. To prevent this, pins should be inserted to hold the clasps very securely in place (Fig. 16). The thinest film of solder possible to make the attachment should be used to keep down the bulk of the appliance (Fig. 17).

The next step is the construction of the "base wires," or "body wires," for the connection of the anchor "arms" across the palate in the upper end and in the sublingual region in the lower.

BODY WIRES OR BASE WIRES.

The body wires are made of 12-gauge for average cases, although the gauge should range from 9-gauge to 14-gauge, varying with age, extent of development required, control of bulk, etc. The body wire can be made into a number of different designs, but the best plan to follow is to use the simplest form suited for the needs required.

The simplest form of upper body wire is made for premolar and anterior expansion only (Fig. 18). This form is made by bending a piece of wire about 6 inches long into a U-shape to fit around the dome of the palate at the desired point across the molar region.

Care must be taken, in determining the points, to bend the ends forward from the points of contact against the molars. If these angles are too high, they will interfere with the occlusion and impart bulk and bad finish. The measurement should be taken with the thumb-nail grasp, and should be made low enough so that the *outer curve* of the wire will only touch, or, failing to touch, will approximate closely the linguo-cervical borders of the molars.

In all heavy wire bending, special care must be taken to calculate the position of the outer curves, and to do this the wire must be grasped in the pliers at a point the diameter of the wire away from the desired point of the bend,

Fig. 19.

Fig. 20.

Fig. 21.

so as to make this allowance in the height of the curve. The palatal part of the wire should enter the sides about midway of the lingual surface of the distal teeth engaged in the appliance, and the ends should always extend forward or backward, as the case may be in the different designs, to about midway of the lingual surface of the tooth at the opposite end of the anchor arms. This will impart a round finish at the ends, which is lost if the ends project beyond these points.

It is absolutely necessary for the side parts of the body wires to extend the full length of the anchor arms to render them rigid. Because the linguo-cervical borders of the molars are higher than the premolars, it will be found that, as the

sides of the body wires extend forward, a space will be formed between the wire and the partial clasps on the premolars. It is in this space, that the ends of the anterior extensions must be fitted and soldered, and the size of the space may be determined by the number of springs to be used (Fig. 18).

Fig. 19 illustrates a body wire for premolar expansion and molar expansion on one side only. Fig. 20 illustrates a body wire for bicuspid and molar expansion on both sides. These are made by bending the wire into the U-shape on the curve of the palate at the posterior region, and then the forward bends are made, to be looped back parallel around the jaw of a round-nosed plier, so that the end will terminate at the molars. Care must be taken to preserve the space in the bicuspid regions for the anterior springs, and this list loop must not be higher than the cervical zone, so that the finished appliance will not interfere occlusally.

The form of body wire found to be most effective for premolar and molar expansion on both sides is shown in Fig. 21. This design contains less material

Fig. 22.

Fig. 23.

than the one in Fig. 20, and responds to the lines of lateral development with better effect. In constructing this style of body wires, the wire is first bent into a U-shape, to rest in the dome anterio-posteriorly, with the ends pointing distally. The ends are then looped over the jaw of the round-nosed plier and brought forward, observing the same precautions as to position and terminating midway of the lingual surfaces of the teeth at the anterior ends of the anchor arms. Body wires ***must not*** touch the soft tissues at any point. After construction, they may be held to position with moldine, and should be tacked to place with a very little solder on both sides (Fig. 21). The finer bending of these heavy wires (Fig. 22) can be made to the best advantage with a plier designed by Dr. Case (Fig. 23). Soldering the body wire to position completes the body and arm portions.

FINGER SPRINGS.

All extensions of springs from these parts are known as "finger springs" or "fingers." "Fingers" are made of Nos. 18-, 19-, and 20-gauge wire, and are

adjusted usually to the surfaces of teeth opposite the direction of movement. "Fingers" vary in design with every individual case.

Careful comparison of a given irregularity with the normal, and measurements to determine the extent and direction of tooth movement, may show the path of movement toward the normal to be such that the arch may be corrected in segments and the study of other conditions may show that all teeth must

Fig. 24.

Fig. 25.

move on individual paths. The effectiveness of the Jackson method is its great adaptability of design to meet varying needs with equal advantage and facility.

Fig. 24 illustrates a condition caused by the premature extraction of the left deciduous cuspid, which, by breaking the proximal continuity of the arch, allowed the muscles to narrow the two posterior segments and drift the incisors lingually from the right cuspid at the center of the rotary axis. The molar ex-

panding body wire is indicated for restoring the two posterior segments to normal width.

One lingual "finger" bent on the normal curve of the lingual surfaces should be attached to the right arm of the appliance. By rendering this finger active with the right cuspid at the rotary center, the path of movement of each incisor will be determined by the radius of the spring from the central axis to the point of contact at each tooth. The path of movement of the left lateral will be outward and to the right on a greater arc than that of the left central. The path of movement of the left central will be on a greater arc than that of the right central. The path of the movement of the right central will be on a greater arc than that of the right lateral. By the pressure of this spring, each incisor will be moved along different paths toward their normal positions, restoring normal incisal relations and concentrating the space gained for the left cuspid.

SOLDERING.

The appliance is shown in Fig. 25 prepared for the finishing soldering on the right side. The "finger" is held to position with moldine, and the spring

Fig. 26.

Fig. 27.

clasps are repinned to place to prevent them from slipping buccally. Zinc chloride is now applied to the entire side freely. The hot iron is dipped continually into the flux before soldering to keep it well tinned and clean. Globules of pure block tin are carried by the iron and flowed well down into the crevasse between the clasps and the body wire. Enough solder should be applied to slightly round off the exposed surface, to impart a smooth finish.

Fig. 26 shows the buccal aspect of the left side finished. A buccal "finger" has been extended to press the cuspid into alignment after ample space is made for it. This illustration also shows how the spring clasps have been shifted to the second premolar and second molar on this side to prevent the need of two wires crossing the occlusion between the first premolar and the canine.

Fig. 27 illustrates the exposed aspect of the soldered appliance ready for removal from the model for the first time for polishing. It also shows the laterals collared with lugs, soldered to the lingual surfaces, beneath which the "finger" snaps to be held securely to position. Here we have an interesting il-

lustration of the control of shifting anchorage for which the Jackson system is noted. All of the posterior teeth are anchored against the labial movement of the incisors. The incisors and right posterior teeth are anchored against the left posterior teeth (ten anchor teeth against four teeth to be moved), which have moved lingually more on the right side. The exposed surface of the appliance removed from the model is shown in Fig. 28.

TRIMMING AND POLISHING.

After a sufficient amount of tin is added to the sides of the arms, it should all be melted along the full length at one time. This will cause it to harden with

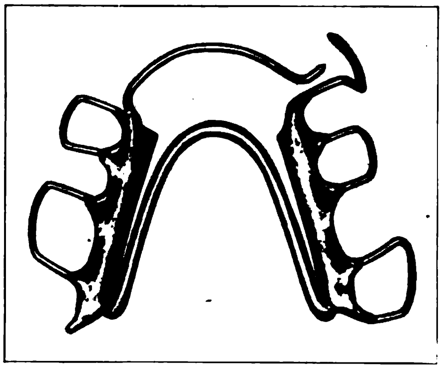


Fig. 28.

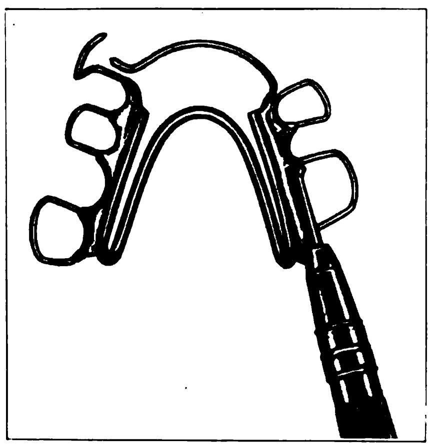


Fig. 29.

a uniformly smooth surface, which will require only a few strokes from a sandpaper disk to prepare for the lathe polishing. The lingual side of an appliance requires very careful attention in polishing. Sharp projections of the partial clasps extending too far interproximally should be cut away. When the solder runs around the ends of all of the wires, completely enveloping them, it is cast against a strip of plaster representing the outlines of the free margin of the gums. If this solder should touch the soft tissues, a slight compression will be

established as the appliance settles. This pressure will exclude the circulation from the capillary terminals and will devitalize strips of tissue, which will resolve into a dense white mass. To avoid this, the palatal side of the tin between the cervical borders of the partial clasps and the body wire should be cut out a reasonable depth, forming a smooth concave surface, with a self-cleansing space between the appliance and the gums (Fig. 29). Great care should be taken in this step to not injure the cervical borders of the partial clasps. They should be left projecting well up above the tin, to enter the cervical constriction at the gum borders. Fig. 30 illustrates this, showing a cross-section cut through the middle of the molar clasps.

After smoothing all sharp points to be found and rounding the ends of the "finger" springs, appliances are to be polished with the lathe. A felt wheel should

Fig. 30.

be used with a stiff mixture of pumice for the exposed surfaces of the tin, which will make the tin very smooth. The palatal portion of the tin can be polished with bristle brush wheels with ample pumice.

After removing all tool scratches with pumice, a luster can be imparted by washing off the pumice, drying the appliance, and reapplying the same brush wheel with which the pumice was used, when the moist bristles with the slight amount of remaining pumice will impart a lasting finish. The final luster can also be made with prepared chalk paste on a camel's-hair wheel.

Jackson appliances retain a triple plate of gold very beautifully. Plated appliances cannot be cleansed so well as the plain surfaces and are more conspicuous.

The next number will continue construction designs and manipulation of Jackson appliances.

A UNIQUE METHOD OF MOUNTING PHOTOGRAPHS

By Carl O. Engstrom, D.D.S., Sacramento, Cal.

The accompanying photograph presents a case of Class II, Division 1, showing three juxtaposed side views of the face, each illustrating a stage in the treatment. The first view was taken in January, 1915, at which time treatment was begun. The second was made June, 1915, or two months before the placement of the retaining appliances, and the third was made January, 1916. In comparison with separate photographs, this combination of views shows to better advantage the changes that occurred as the result of orthodontic treatment. In looking from one object to another, distraction of the mind is natural, and the amount of distraction is in direct proportion to the distance of separation.

Hence, the closer together the objects are, the less the distraction of the mind, and the more definite, comprehensive and correct the observation.

Three separate negatives were used in printing this photograph, and each was a full side view. A screen of yellow paper was prepared approximating the profile of the second view. This was used in the printing of the first negative to screen the sensitive paper, thus keeping it clear for the reception of the second view. When the second view was printed, the first profile print was covered, and the second negative screened to protect the paper from the reception of the third print. By this means many views may be printed on one paper. If the plate is

so placed in the printing frame that it sets a little back of the one printed in front, a more distinct profile is produced, owing to the clear field previously maintained by the screen. However, the hair may be screened so as not to allow this space, thereby causing a blending of the views in this region.

In the study of these pictures, note that five months intervened between the first and second views, and seven months between the second and third views. Also, note particularly the development of the lower jaw. Aside from the changes in the face, most striking changes are evident in the physical structure and the mental attitude of this patient.

INFECTIONS OF THE ANTRUM *

By E. M. Seydell, M.D., Wichita, Kansas.

THE subject of my paper is one familiar to all of you. It is a condition caused both by infections resulting from pathological conditions in the mouth, and by direct infections of the mucous membrane lining its cavity from the nose, and therefore is of interest to both the dental surgeon and the rhinologist. From an anatomical and physiological sense the sinuses belong to the nasal cavities, being lined with the same kind of epithelium and supplied by branches of the same blood vessels, and communicating with one another through openings in their bony walls. Rarely the antrum also communicates with the ethmoidal and sphenoidal cells. Until late years it was supposed that the majority of the infections of the antrum were of oral origin. Lately there is a tendency to believe that they are mostly of nasal etiology. It is of course natural to suppose that the majority of those cases seen by the dentist are of oral origin, yet, in my experience fully 25 per cent of the cases sent to me by dental surgeons have been of nasal origin. Etiologically speaking we have the genuine mucous membrane inflammations resulting from an infection of the nose. Acute coryza (acute rhinitis) may extend by continuity of surfaces, or by indirect infection, to the sinuses. Therefore the causes of the former, which are infinite in number, may also be accounted exciting factors in the causation of maxillary disease. Among the other prominent causes may be cited those infections caused by the micrococcus catarrhalis, influenza bacillus, the bacillus segmentosus, the pneumococcus and the exanthematous diseases. Diphtheria and erysipelas must also be mentioned. In any mucous membrane infection the liability to infection of the antrum is greatly enhanced by improper drainage due to septal deviations, enlarged turbinates, polypi, etc.

Again in many of the chronic systemic diseases as in diabetes, rheumatism and tuberculosis, we find a predisposition toward sinus disease. I will also mention nasal operations, nasal tampons and other injudicious dressings, foreign bodies, vomited matter, etc. The antrum may become infected by extension from the oral cavity. This is prone to occur where the roots of the teeth are only separated from the floor of the antrum by a very small plate of bone, as in those cases of sinus alveolaris, or in the rather rare instances where the roots of the teeth actually project into the antrum. In either of these cases it is easy to see that any of the various inflammations around the roots of the teeth may easily produce an antrum infection. Infection may also be carried into the antrum by the dentist "accidentally" perforating the alveolar process; trauma of other nature may cause infections. The pathological conditions of the superior maxillary bone, with which you are all familiar, might be divided into: (1) The acute root abscesses, brought on by caries of the teeth. (2) Acute periostitis which follow the extraction of a tooth where the antrum has been opened by the operation. It is not often that the puncture causes the trouble, but the subsequent infection of the alveolar process extends into the

*Read before the Wichita Dental Society, February 8, 1916.

antrum and thereby produces an infection. This is even more apt to occur where the opening has been made in extracting a tooth where a previous periosteal abscess existed. The second premolar and the three molar teeth are usually beneath the antrum and therefore are the causative factors in most of the cases, but the canine and even the second incisor have been known to produce the infection of the antrum. (3) Thirdly we have those cases of circumscript and diffuse osteitis of the alveolar process. This may have its origin in caries of the tooth or be caused by trauma or osteomyelitis, and by causing a necrosis of more or less of the alveolar process, affect the antrum. We will now consider those chronic inflammatory changes of the roots of the teeth and the alveolus, which may affect the antrum. First we may cite those cases of periodontitis in which the grauloma, or epithelial lined purulent cyst, at the apex of the root, causes a resorption of the overlying bone, encroaching upon the mucous membrane of the antrum and finally infecting it. Durchwanderen "wandering through" of an infection through the alveolar process from an inflamed root, is undoubtedly the cause of many other infections. It has been shown by Hinsberg and Hyjek that it is possible to have an extension of an infection through the walls of the frontal and sphenoidal sinuses to the neighboring parts without any macroscopic changes in the bone. We have all seen cases where it was possible to demonstrate an opening through the root canal, upward into the antrum, which could not be found after extracting the tooth, due to the minute opening in the alveolus. Microscopically, it would no doubt be possible to find the infected tract through the seemingly normal bone. I also find mentioned as etiological factors, improperly placed crown pins and root canal filling, of gutta percha, etc. Late literature has shown that an almost unbelievable number of cases in which the teeth are filled, and are not giving any apparent trouble can be shown by x-ray examination to have apical abscesses. The reason that we do not have more antrum infections from these sources is no doubt due to the protection afforded by the lining membrane of the sinus. Among the pathological changes of the mucous membrane of the antrum we must consider the acute catarrhal inflammations. Here we find the membrane edematous, thickened, and infiltrated with a yellowish fluid. The changes may either recede, and the mucous membrane take on a normal appearance, or a chronic condition may result. Microscopically we find a round cell infiltration of the upper layers of the mucous membrane, the epithelium remaining unchanged. The connective tissue spaces being enlarged and containing fluid. In the chronic forms we find that the deeper layers of the mucous membrane are also involved.

The tissue becomes spongy and very much swollen, sometimes attaining ten to fifteen times its normal thickness, which is termed the edematous form. In other cases, we have a hyperplastic condition which probably follows the former. Here we find a hard pale membrane which may almost obliterate the antral cavity, or may cease development at any stage. Microscopically, we find in the edematous form a round cell infiltration of the subepithelial layers and around the mouths of the glands. The connective tissue fibers are forced apart and filled with fluid. In the hyperplastic, we have a scar-like degeneration of the connective tissue fibers, with a closure of the gland ducts and cyst forma-

tion. Next in order are the acute empyemas, in which we find edema of the mucous membrane with hemorrhages here and there; the surface of the membrane being covered with pus. The tissues are usually not as swollen as in the acute catarrhal form. The microscopic changes are similar to the catarrhal, except that pus is present. There may be a complete restitution or the condition may become chronic. In rare cases we find a fatty degeneration of the pus with which the antrum is filled forming a material of cheese-like consistency. In the chronic empyemas, we find practically the same changes as in the chronic catarrhal excepting the purulent or mucopurulent discharge. Ulcerations of the mucous membrane may occur and cysts and polypi may be found. The pathological condition of the mucous membrane of the antrum may show edematous changes in one portion and hyperplastic in another. Oppikofer found metaplasia of the ciliated epithelium to stratified squamous in thirty-five cases out of one hundred examined. Finally we may have a diphtheritic inflammation of the mucous membrane with its usual changes.

Rarely the inflamed condition may cause bone changes in the walls of the antrum, which may result in perforation of the same causing abscesses, or phlegmons, in the areas into which they perforate. This complication may result fatally as can be easily seen, when one remembers the structures which surround the antrum.

The pathological conditions which favor perforations are infections along the veins which traverse the bone. Further it is no doubt true that many of the severe complications are not due to perforations, but to an extension of the periostitis accompanying the severe forms of dental infections. As a result of inflammatory conditions of the antrum we may find mucous membrane cysts, these are common and may be single or miliary. Polyps of the antrum are rarer. Osteophytes and rhinoliths may also be mentioned. Lastly, I will mention the condition known as hydrops antri, which is an accumulation of free serous fluid of inflammatory origin due to a closure of the natural opening, causing a dilation of its walls.

Symptoms.—Pain is one of the most important subjective symptoms of antrum trouble. Local tenderness or pain is only found regularly in acute empyemas of dental origin where considerable periostitis is present, and in very severe influenzal, and erysipelatous infections. The character of the pain being one of tension, is usually most pronounced in the region of the frontal process of the maxilla. The pain may be constant, or "neuralgiform" in character. This may be accompanied with neuralgia of the supradental nerves, causing a dull ache in the upper teeth, or the patient may complain of a sensation of lengthening of certain teeth. With the above, or appearing as the only symptom, one may have a supraorbital pain. This may only appear at certain hours of the day. The pain in the chronic forms, unless there be an acute exacerbation, is not characteristic, nor localized.

Objectively the most important symptom is the appearance of a discharge from the nose, or a postnasal dropping; it may appear in large, or small quantities. In those cases, where a periosteal abscess breaks into the antrum, the patient suddenly expells a large quantity of stinking pus. In the chronic forms there may be a continual discharge, to which the patient may become accustomed, and it

may be impossible for him to remember when it was first noticed. The acute exacerbations are noted as acute colds, etc. These patients come to us to be cured of their catarrh. In some cases there is only a postnasal dropping, or a dry condition "pharyngitis sicca" of the nasopharynx, pharynx, or even the larynx. This is usually present in those cases where a nasal obstruction prevents the discharge from being expelled through the nostrils. Cacosmia, that subjective symptom where the patient is able to detect an odor arising in his nose, when it is not noticeable to others, is characteristic of antrum disease. Other subjective symptoms are nasal stenosis, loss of sense of smell, etc. Symptoms due to absorption of the pus from the antrum, or caused by swallowing the purulent material, will not be discussed. Objectively, we usually find pus in the middle fossa of the affected side, which after being removed usually returns, again only dry crusts are found. In some cases of nasal stenosis it is only possible to detect the pus by posterior rhinoscopy. Again by placing the head in a favorable position we may be able to demonstrate pus in the nasal cavity. The chronic inflammations are often accompanied with polypi. These are not characteristic unless found unilaterally, and in the middle fossa of the nose. Swelling of the cheek, and edema of the lower lid are usually only found where a periostitis of dental origin is the causative factor, the exception being the severe forms of influenza and erysipelas. We also sometimes see a fleeting edema, and redness of the skin over the antrum.

Diagnosis.—Due to the variety and inconsistency of the subjective and objective symptoms it is only possible to make a positive diagnosis of antrum infection in a few cases without rhinoscopic examination. This can really only be done in those acute cases of infectious origin where the condition starts with chills, fever, discharge, local tenderness and swelling and neuralgiform pains over the facial distribution of the infraorbital nerve; also, more rarely, in those cases of dental origin, where following a periostitis, or the extraction of a tooth, we suddenly find a discharge which had not existed before. It must be remembered that we may have bad teeth on the side affected, which may even communicate with the antrum, and the history show an acute evolvement, but in examining the nose we may find polypi, or other evidence, which shows that a previous infection existed, not only in the antrum, but in other sinuses as well. The frequency of more than one sinus being infected at the same time necessitates a thorough examination of them all. Most often, especially in the chronic cases, the symptoms are not characteristic and the picture is not complete, in fact we may have only one symptom, the appearance of pus in the nose, or nasopharynx. To prove that this originates in the antrum is the object of our search; after cleansing the nose, note the appearance of fresh secretions in the middle fossa. If no pus is present, or none returns, place a tampon saturated with cocaine and adrenalin under the middle turbinate to shrink the swollen tissues, and then use the suction apparatus. If the appearance of fresh pus is established we must differentiate between an infection of the frontal sinus, ethmoidal cells, and the antrum, as these sinuses all empty into the middle fossa. My next step is transillumination. One cannot entirely rely upon the findings of this diagnostic aid, due to the differences in the normal thickness of the facial bones, both uni- and bilaterally. We may have bright transillumination with some pus or mucous present or darkness

where none exists. A periostitis or a previous inflammatory condition of the antrum may also darken one or both sinuses.

The x-ray may also be utilized, but again it is possible to err, especially in interpreting the plates. The cost of the procedure makes it impracticable in many cases. The teeth on the suspected side should receive an exceedingly careful examination by a dental surgeon. If diseased roots are present they should be probed under aseptic conditions with great care to establish any communication with the antrum. If necessary x-ray plates of the apices and aveolar process may be made.

We can now proceed to the positive method of diagnosis; washing out the sinus either through its natural or artificial opening. If I find it impossible to catheterize the normal opening I puncture the nasoantral way well up under the lower turbinate, which may be accomplished with practically no pain. I am not in favor of making an exploratory opening through the aveolus or the canine fossa, due to the possibility of infecting a normal sinus or complicating an infection already present by a bacterial flora which is foreign to the nose and pathogenic to it. It was formerly practiced by dentists and rhinologists alike, but is very rapidly falling into disuse even among the dental surgeons.

After a presence of pus has been proven to exist in the antrum one must exclude those rare cases where the antrum merely acts as a reservoir for the secretions of other sinuses. Dentigerous cysts and malignant disease must be considered.

Prognosis.—Acute cases may end in recovery, chronic suppuration, or death. The prognosis is usually good, especially in the cases of nasal origin. Death very rarely occurs. It is impossible to give the patient a positive prognosis in the chronic suppurative conditions of the antrum. They almost never heal spontaneously. Personally, I have been exceptionally fortunate in the cases that I have operated upon in a radical manner, but have had a number of failures in the conservative methods of treatment.

Treatment.—There are at least twenty-five accepted methods of operative treatment for antrum infections, so it will quite naturally be impossible for me to discuss so lengthy a subject. I will, therefore, adhere to those methods I have found practicable or impracticable.

The treatment rests upon the accomplishment of two factors: the removal of the cause, and drainage of the secretions. The first of these factors can practically only be carried out in those cases of dental origin where it is possible to remove the causative roots, or open the periosteal abscess and perhaps remove a sequestrum of bone. In rare cases one may be called upon to remove a foreign body. The second factor may be divided into the conservative and the radical methods. Under the conservative we may try the washing of the antrum through its natural opening. This method can only be used in a few selected cases, due to the natural limitations, small ostia, thick secretions, deviations of the septum, etc. Next I will mention opening the antrum below the lower turbinate, with a subsequent enlargement of the opening if necessary. With this method I have had very good results, and never advise a radical operation until this has been given a thorough trial. The opening can be enlarged so that the patient experiences no difficulty in treating the condition himself, if this is necessary. I wash

out the secretions daily at first, and as the same diminish, lengthen the interval. Care should be taken that no wash water is left in the antrum after cleansing.

The opening through the aveolus (Cowper's operation) I only recommend in those cases where a periostitis, following an abscessed root, has broken into the antrum. The opening through the canine fossa is very unsatisfactory.

In radical operations, I have found that for ordinary conditions I get the most satisfactory results from a modification of the Canfield-Ballinger or preturbinal operation. This operation can be performed either under local or general anesthesia. There is no opening communicating with the oral cavity. No destruction of physiological tissues. Rapid healing. The Caldwell-Luc is preferable where the nasal cavity is small. Also where it is necessary to keep the antrum packed for a long time as in necrosis of bone in the floor or walls of the antrum. The Denker is only necessary where an extremely large opening in the antrum is required as in cases of new growths. I am a firm believer in giving the conservative methods a thorough trial. Failing in this I heartily recommend the intranasal operation of Canfield-Ballinger.

PREVENTIVE DENTISTRY

An Answer to the Present Dental Dilemmas*

By Dr. W. A. Chamberlain, St. Louis, Mo.

IS THERE any more fitting answer to the present day dental dilemmas than Preventive Dentistry? Consider the conflicting theories of the different branches of dentistry, which according to the present day authorities create difficult problems, which any dentist who is prompted by a desire to render honest service of the highest type, would be glad to avoid.

ROOT CANALS.

Was there anyone who heard Dr. Best who did not feel impelled to avoid all the root canal work possible, and to make an unusual effort to save the pulp rather than devitalize? Who would not now inflict a little more pain on the patient, and possibly wear on himself with the stress of the painful operation, rather than undertake the difficult, and in some cases impossible, root canal work?

Root canal work, the latest sensation in dentistry, and possibly indirectly so in medicine, by way of focal injection, has, to my mind, created many dilemmas. There was a time not long ago when I felt that all the methods of dental practice had been standardized, but now periapical conditions resulting in alarming general systemic conditions, have complicated most all branches of dentistry.

Reading an article by Dr. Raper along these same lines, he quotes Dr. Carr who says, "That if you do not do proper root canal work, the patient has heart disease, and if you do, the patient has heart disease when he gets the bill."

The root canal experts claim that there are a certain per cent of teeth which, on account of their abnormal anatomy cannot be properly filled, and that these

*Read before the St. Louis Dental Society, April 4, 1916.

teeth should be extracted regardless of other dental laws. These teeth may be any from the incisors to the third molar and because of the very serious and vital consequences that are possible, resulting from the unfilled portion, which serves as a focus of infection, it is advocated to extract at once.

Of those remaining, which by use of x-ray are found to be of such development as to permit of proper treatment and filling, there are several dilemmas created in the matter of devitalization in the vital teeth, and in the treatment of those in a putrescent condition.

DEVITALIZATION.

Arsenic, the most generally used devitalizing agent, and I should say satisfactory to the patient as well as to dentist, because of the ease of making the application, is no longer indicated. We are now informed that arsenic is so powerful and penetrative, that it attacks the periapical tissue, lowering its vitality so that it is susceptible to infection through the blood stream, even though perfect canal work has been done under aseptic conditions.

If arsenic is not used, we are confronted by the difficult conditions in accomplishing pressure anesthesia. Many cavities are located where the access is so difficult as to preclude this method. A more accessible cavity could be drilled, but that seems like unnecessarily mutilating the teeth. Then there are conditions of the pulp where to use pressure anesthesia would mean to force the bacteria of the cavity, or bacteria and bacterial toxins which may exist in a still partially vital pulp into the periapical tissue. This is not desirable, of course, and may be followed by complications.

Conductive anesthesia eliminates most of us, because of the skill and technic required. Furthermore, it is the opinion that very few patients would submit to it. Infiltration may be used with more or less success, and more or less pain.

General anesthetics may be used, such as nitrous oxide, and are very successful in single rooted teeth, but in posteriors experience has taught that it is not well to try them.

Of the two methods to choose between, pressure and general anesthesia, neither is successful in all cases, and both may be possible in some.

TREATMENT.

In the treatment of putrescent root canals periapical conditions result from the use of too strong drugs.

Dr. Buckley, in working out the chemistry of pulp decomposition, and the treatment for putrescent canals, gave us trikresol and formaldehyde as a specific. He showed how the treatment could be sealed in such a tooth without fear of gas pressure. How secure we have felt in the use of it, and now we learn that the formaldehyde is destructive to the apical pericemental tissue, as well as the germ which we pictured as lurking in the dentinal tubules.

In vital teeth if the canals are too fine for proper removal of the pulp tissue and proper filling, the canals must be enlarged first by smooth broaches and next by canal files aided by the decalcifying effect of a 20 per cent H_2SO_4 solution or paste. Just about the time the apical foramen has been successfully reached with a good sized broach, it is suddenly realized that the presence of a strong H_2SO_4 solution is hazardous.

FILLING.

After the difficulties of devitalizing and of treating putrescent canals, then comes the difficulty of filling them. It is claimed that in everyday methods employed in the average dental operating rooms, there is great possibility of infecting directly the apical tissue, and that consequently every such operation should be according to strict surgical procedure. Everything coming into contact directly and indirectly with the patient's tooth should be sterile.

CROWN AND BRIDGE.

In Dr. Goslee's text book on Crown and Bridgework, he gives as the concensus of opinion that all crowned teeth should be devitalized. Now there is fear to destroy the pulp in such teeth because of the consequent local and systemic deleterious consequences. Not because Drs. Rhein, Best, Ottolengui and others have shown us how it can be done successfully from the theoretical standpoint, but because in everyday work there is a margin of insecurity between the theory and practice. Consider the dilemma after deciding to devitalize a badly broken down upper bicuspid for the purpose of adapting a porcelain crown, to have the x-ray disclose one of the impossible roots. Would it be decided to extract and go on to the next one, or to forget esthetics and apply a gold crown or a gold inlay?

If the pulp is left in the tooth which is properly prepared by grinding for the crown, the dentist is confronted by the theoretical surgical impossibility of the irritation of cement in contact with mesoblastic tissue. If the enamel is left under the crown, the gum tissue suffers from the irritation of an improperly fitting band, creating thereby a disposition to gingivitis, and eventually pyorrhea, with the added danger of hematogenous infection of adjoining teeth where the periapical tissue is in a state of reduced vitality.

During this winter I have heard stated before this society, that insanitary bridges were giving way to removable dentures, and the day would come when partial plates would predominate on account of their sanitary features.

BACTERIA.

I want to quote from an article by Hewitt in the March issue of the *Dental Cosmos.* "Adami, in speaking of the defenses of the body against infection, discusses the mucous membrane with its underlying structures, as to its resistance to the entrance of infection and the conditions which allow infections to enter. Bacteria are constantly entering the organism, but in health they tend to be destroyed very soon after their reception. Certain leucocytes or wandering cells passing out on to the surface of the mucous membrane, act as a scavenger, and this either by actually taking up the microbes and digesting them or by carrying them back into the tissue where they can be destroyed. It is not necessarily the destruction of the surface layers which allows infection, the lowering of the vitality of the tissue is of the utmost equal importance."

He goes on to describe cryptogenic infections as lesions occurring in deep seated parts with no apparent break in the integment. "Cryptogenic infection can occur through the unaltered surface of the mucous membrane by the agency of the wandering cells of the organism, if the following conditions exist.

1. The presence of an excessive number of virulent organisms at one surface point.
2. Congestion of a mucous surface with the passage of an increased number of leucocytes.
3. Re-entrance at one region of an undue number of the same, bearing with them microbes.
4. Accumulation at one spot of recurrent deposits of such numbers of microbes that the bactericidal power of these cells become exhausted, and lastly,
5. Temporary or habitual lowered vitality and resistance to the introduction of the microbes."

All these conditions are fulfilled when we have a partial plate resting on the mucous membrane in conjunction with a pulpless tooth, which may have been filled with the utmost care; viz.: many organisms resting on the surface of the plate in close contact with the gum congestion, with the passage of the leucocytes bearing microbes to a weak spot in the apical regions. As suggested our supposedly sanitary partial plates will cause congestion of the gum tissue and consequently increase in the number of germs constantly being carried through the mucosa.

He goes on to say, "All the submucous tissues are subjected to a shower of pathogenic organisms entering both by wounds and through the tissue surface. The more congested this mucous membrane, the greater the number of germs which will enter."

This explains hematogenous infection nicely and applies to any colony of bacteria in contact with mucous tissue, whether it is on a plate, the saddle of a bridge, in food deposits around the necks of teeth, under overhanging fillings or crowns which encroach upon the gums, or in large deposits of salivary calculus. When any of the above conditions exist there is irritation with inflammation and reduced vitality. This means in the presence of large colonies of bacteria, the bactericidal power of the tissue cells is sooner or later exhausted, and the germs gain entrance to the tissue and blood.

A full complement of teeth, the orthodontist tells us, is necessary to normal occlusion and the normal locking of the cusps of a full complement of teeth is the vital retentive force following orthodontic treatment. Supposing it were necessary to devitalize a tooth through some lack of care during orthodontic treatment, and the x-ray showed the roots mal-formed and turning off at a sharp angle near the apex, would you extract and create another dilemma?

The physician, the guardian of the health of the individual, may trace or think he traces some systemic disorder to a focus of infection about a tooth and says extract. In such cases the mandate of the physician overrules the dentist. Perhaps the dentist knows that the patient will be benefited 50 per cent from the standpoint of infection, but damaged 70 per cent in the loss of chewing efficiency, indigestion and lowered vitality creating a possible dilemma of a vicious cycle of disasters.

PREVENTIVE DENTISTRY.

To all this confusion of conditions, is there any more satisfactory, more effective, and more beneficial answer, than Preventive Dentistry? Preventive Dentistry means, keeping all surfaces of the teeth clean, employing all known

means both by the individual and by the dentist, and should be based on Black's statement, "That teeth decay when they are habitually unclean and in structural defects." Consequently there should be instructions to the patient for his individual home treatment and office treatment by the dentist.

HOME TREATMENT.

The instructions to the patient are first: to equip himself with a proper tooth brush, one with the bristles arranged in tufts, and the length of the bristles graduating from the short bristles at the end to long ones near the handle. Inasmuch as it is the end of the bristle which does the cleaning, none of them should be so long that they bend over while sliding the brush over the teeth. This brush reaches the buccal surfaces of posterior teeth, especially because the further distally between the cheek and teeth, the narrower the space. The same holds good on the lingual of the lower molar. Start the brush on the gums, and with a rolling motion sweep down over the teeth. This cleanses the maximum tooth surface by allowing bristles to go between the teeth. It also massages the gums, and keeps them from receding, a tendency brought on by age.

Instruct the patient to use ordinary dental floss for polishing between the teeth in younger people and flat floss in older people, together with soft wooden toothpicks in those whose gums have greatly receded. Use a saponaceous tooth paste and finish with vigorous rinsing of lime water.

In time, with proper instruction, the patient will become most proficient with his mouth toilet. A good idea is to give the patient instruction to start at the hardest place first with the tooth brush, and finish at the easiest. Usually it is the other way, the patient beginning with the easiest place, which is the labial surface of the anterior teeth, a place which is kept fairly well cleansed by lip movement, and the excursion of food in the process of biting.

I have never heard a theory advanced for the popularity of a soap in dentifrices, except that of the action of the soap as a cleanser, and that it is right in line with the alkaline treatment. The theory of the detergent action of soap is partly that of an emulsifier, and largely that of an alkalic regulator, that is by what is known as hydrolitic disassociation. This means the soap is broken down by water into other substances of an alkaline character.

Pickerill's theory of acid mouth washes is a beautiful one, and was loudly heralded by the dental profession, who took to it quickly and extensively. Time has piled up more testimony against it than for it, so that judging from the expression of opinion among the profession the alkaline prophylactic treatment seems to be the most popular.

In the prophylaxis symposium published in the *Items of Interest,* May, 1915, Dr. Fones and others advocate the use of lime water as a mouth wash. The present day idea in Preventive Dentistry is to get rid of the gelatinous plaques in which the lactic acid bacteria flourish, producing their tooth decalcifying products. We are endeavoring to find some solvent for the gummy plaques which form in sheltered places about the teeth, inasmuch as it is almost a mechanical impossibility for the average individual to reach all surfaces of his teeth in his daily care.

Pickerill, and others claim that alkalies are the best solvents for mucin,

and it is upon this fact that Pickerill's theory of maintaining an alkaline saliva by means of an acid mouth wash is based.

Pepsin dentifrices have been introduced, and again the theory is beautiful. but as far as I can observe and learn, it does the work in practice.

The solvent effect of these agents mentioned, is more or less slight, and until some agent can be found which when taken into the mouth has quick acting effects, mechanical means will have to be depended upon largely.

Dr. Talbot stated in a paper, or a discussion before the Section of Stomatology of the American Medical Association, that if his solution of Iodo-glycerol was used to swab the buccal cavities three times a week, it would stop decay. and overcome the sensitiveness of denuded roots. Iodine has great penetrating properties as well as germicidal properties, and will penetrate the mucous plaques as well as deposits of fermenting food. In extreme cases of dental caries, I have prescribes this treatment and believe it is very effective.

The patient should appear at the dental office frequently, that is as often as is necessary, depending upon the success of his own efforts, and the tendency for plaque formation.

These plaques should be removed at short intervals, because the lactic acid germ begins the elaboration of its products at once. The rapidity of the decalcifying effects is governed by the resistance of the tooth, by which is meant the molecular arrangement of its structure; by the virility of the germs depending upon their favorable or unfavorable environment; by the carbo-hydrate medium, and by the neutralizing effect of alkalies in coming in contact with the colonies and their products.

It should depend upon each individual, and not be according to a general rule as every year or every six months; it should be every two weeks or every month as seems indicated. If each time the patient returns to the office, a disclosing solution is used, the places which he is not successful in reaching with brush or floss will be brought forcibly to his attention, and his efforts with his home treatment extended accordingly.

OFFICE TREATMENT.

The office treatment should consist of removing all calcareous deposits above and below the gingiva with delicate instruments preferably the Younger-Good pyorrhea instruments. Next polish with flower of pumice, or some diatomaceous earth, using dental engine with cup and disks. The hand porte polisher may be used with orange wood points instead of the dental engine, or may supplement the rubber cups and disks after which flat floss letter (R) should be used in polishing the proximal surfaces. Not only pass floss between the teeth but polish the proximal surface carefully with plenty of abrasive flooding the field of operation. Finish with spray using compressed air.

The sulci and pits of permanent teeth especially in the newly erupted, should be cleansed with engine polishing brushes and abrasive; then the tooth should be dried and the pits and fissures should be flooded with 20 per cent Ag No_3 and worked in with a sharp explorer. This should be dried and either white or black copper cement worked well into all the crevices, leaving as much on the occlusal surface of the teeth as is possible without interfering with occlusion. This

cement will gradually wear away, leaving the fine lines still sealing the weak places for a long period of time when the same can be repeated.

To consistently carry out this work to a practical degree, the services of a dental nurse are needed, and here another dilemma presents itself. It is hard to find a young lady who will take a dental course, and without a college degree, it is not lawful for an assistant to do this preventive and prophylactic work.

In conclusion I would say that prevention is a modern tendency expressed in the slogan, "Safety First."

That proper prophylactic work prevents dental caries; that it prevents pyorrhea, the disease which is causing the loss of so many teeth, and so much health, and about which there seems to be in the minds of the laity so much mystery. That prophylactic work prevents the necessity of root canal work except in some unusual cases.

That a sound tooth is much better in looks, strength, and a part of the human anatomy than any tooth devitalized, regardless of the most perfect root canal work, and that in children's teeth, it prevents a certain per cent of malocclusion.

To the patient, it is commercially profitable directly and indirectly, and last of all it is pain profitable.

I trust that the profession will work out some solution of this situation which will enable the dentist to carry out the idea of preventive dentistry to the last degree.

HARD LUCK

By an Orthodontist's Patient

I

I am having my teeth put in place,
By a very slow moving thing,
I have to wash my face,
So he can bring them back in place.

II

I don't see why my teeth are crooked,
For though I have looked and looked and looked,
My, what a joy it must be,
To have straight teeth NOT like me.

Rexford Louise, Age 9.

MODERN OFFICE APPOINTMENT FOR THE ORTHODONTIST

By R. C. Willett, D.M.D., Peoria, Illinois.

SECTION I.

ORTHODONTIA as a profession is progressive. Few professions, if any, have developed more rapidly along constructive lines. This exceptional progress is due in no small respect to the fact that the profession is made up largely of young men of enthusiasm and ambition, who, not satisfied with the ordinary things of practice, decided to enter into more highly specialized work —even though that work were pioneer work. Youth and ambition and energy, together with the zeal which characterizes any pioneer, will make any work progressive.

But, while the scientific side of the profession has developed steadily and rapidly, the office appointment side has been sadly neglected. We have been so engrossed in the scientific advancement—and that is a good failing—that we have failed to spend the time and energy and thought which is necessary in securing the very best dress in which to present our skill, our profession and our service.

It is the object of this article to point out some of the unprogressive things which are still typical of some orthodontists' offices. Some of these are the mosses which were inherited from the older professions. Others represent a certain "orthodontic orthodoxy," which has no excuse for existence in our profession, but which has developed even though our profession is still young. These unprogressive things, which will be mentioned, are all in the office appointment side of our work. They are cited here, not as an excuse for a criticism, but in order that the errors of office appointment may be seen plainly. Nothing corrects an error more quickly than exposure to the light. The office of the average orthodontist is more satisfactory in appearance than is the office of the average man in other professions—but that is no argument why the office appointments of the orthodontists should not be much better than they really are. If perfection is our goal in the scientific side of our profession, there is no reason why perfection should not be our goal in the office appointment side.

The writer cheerfully confesses the appointments of his own office are far from perfect—although he is making an earnest effort to correct the defects and to supplant the previous old customs with more appropriate features.

It seems to me that of the needs of the orthodontist, the need for sensible, consistent, thoughtful office betterment is well toward the front—granting, of course, that the paramount need is always for continued study and practice in the actual constructive work of the profession. Isn't it time that a progressive profession, such as we represent, should have men with offices fitted up in accordance with the most progressive ideas of applied art and psychology? Should out-grown customs and out-grown habits hinder a progressive profession? If practical psychology can be used to advantage in working out office plans and equipment for men in other professions, can it not be used to advantage in a similar respect by the orthodontist? The very nature of our work demands it.

Why has not some writer of Mark Twain's talent and nature appreciated the possibilities for humor which are in the office appointment of the average orthodontist? For where are there more incongruities, more unsightly displays, more exhibits of abnormalities, more inappropriate wall decorations, more reckless selection and distribution of bric-a-brac, more conspicuous display of professional accomplishments, more unreadable magazines for the average patient, and more abuse of real art, than in the office of the orthodontist?

An office, according to the lexicographer, is "the place where a particular kind of business or service for others is transacted." That simple definition is sufficient for me. It follows, indirectly, from the definition, that office equipment, office furniture, office furnishings, should at least not hinder this "service for others," and that it should really be of assistance in helping to serve, for it is a substantial part of the office. But, judging from the appearance of the offices of some orthodontists, I am led to the opinion that these orthodontists have a wholly wrong idea of the real importance of the "service" side of the office.

Let us consider a few types of offices where "service" seems to have been left out of the definition. These may be partially typical of some offices of which you have some knowledge, and a mixed type may be easily found.

The most striking office is that which we might term the "museum-of-abnormal-curiosities-office." You have seen it and so have I. Leaders in the profession have been known to have just such an office—strange as it may seem. Men who have developed valuable theories for our profession, and men who have been pioneers in many branches of our work, have labored under the strange delusion that the public part of their offices must be filled with plaster models of the various types of jaws and irregularities of the teeth, plaster masks of distorted faces and other abnormalities.

Is there even the semblance of a reason for the flaunting of these figures in the faces of children who come to us for treatment? Does the presence of these unsightly, unpleasant, ghastly, gruesome, plaster figures give our patients any particular sense of pleasure or comfort when they visit and re-visit our offices? Is a child made more receptive to treatment by compelling him to look at the plaster masks of unfortunate children's faces?

I am in love with my work and I trust that all other orthodontists are in love with their work. I appreciate the absolute necessity for having plaster models and face masks—and many of them. I appreciate the importance of having these models as perfect as it is possible to make them, and to have them where it is possible to get them without inconvenience when they are needed; but I am unalterably opposed to having these figures—unsightly and disagreeable to the average patient—flaunted in the faces of patients and visitors from the walls and cabinets of the orthodontist's rooms.

Plaster of Paris models of deformed jaws may have real art in them for the orthodontist, but I have yet to find an authority on art or a lover of art who will say that there is even the smallest iota of art in these figures for the average person who visits an orthodontist's office. However, there are orthodontists who, cherishing a chalk-white plaster model of some facial deformity, would lead you to think that it is real art, and who actually place miniature models of Venus de Milo along with his own plaster creations. Plaster models of de-

formities may be just as much art to this individual orthodontist as is the reproduction of this great Hellenistic statue—but wherein did he receive the authority to force this opinion upon the patients who visit his office?

Along with the open exhibit of models we frequently see photographs of cases before and after treatment. It is an absolute necessity—if an orthodontist is to keep close record on his work—that a photograph of his patient be taken before and after orthodontic treatment. This is universally conceded. But what Chesterfieldian rule is there which makes it good taste, good manners or good sense to post these photographs in a conspicuous place around a professional office? They should be kept in a place where they may be easily found when occasions demand—but why exhibit such accomplishments?

And then there is the "Old-Curiosity-Shop-office." You have seen it and so have I. In one corner there is a wall rack which may be a family heirloom, a cage of moth-eaten stuffed specimens of the taxidermist's art, and a clock which isn't running. Over against one wall is a bamboo stand, piled high with books. Then there are some sea shells—sea shells are in nature "washed twice every twenty-four hours," but these never. There are some ancient stereoscopic slides on an old table, and plenty of dust—there is always lots of dust in the "Old-Curiosity-Shop-office."

The center table in this office is covered with weekly magazines—magazines of a highly sensational type. And let it be said that no class of reading matter grows old faster in an office or becomes unreadable sooner than does a weekly journal. This fact, together with the fact that a highly sensational magazine is ill-suited for the perusal of a child, should be sufficient to cause us to guard against the use of sensational weekly magazines in our offices. If there are any monthly magazines in this office they are often frayed at the edges and several months old. Perhaps all these magazines are of the type which have no appeal to the children—a class which constitutes perhaps 95 per cent of the orthodontist's patients.

There are said to be orthodontists who conduct an "Old-Curiosity-Shop-office" who are really proficient to a remarkable degree as professional men. But it is hard to believe that a man can show such a decided lack of interest in his office and then show any unusual interest in his professional work.

And the third type of office is the "I'm-a-wonderful-man-office." You have seen it and so have I. Everything, apparently, is devised to give the patient the impression that the orthodontist is a wonderful creature. Photographs on the walls reproduce scenes along the Nile which Dr. Orthodontist saw while on a world tour a few years ago. In a glass case in his operating room are the instruments—displayed like costly silks in a department store. On the walls are various and diverse diplomas from the Homeburg high school, an academy, college, university and technical school—all of them as big as life. Then there is the certificate displayed also in a decidedly conspicuous manner, photographs of patients whom he has transformed, and other things which indicate that this particular Dr. Orthodontist is the very essence of professional skill.

All this evidence of self-praise might be well enough if it were not for the fact that there is but one thing which really advertises an orthodontist—and that is, the service which he gives. Diplomas represent a valuable thing, but

their presence on the walls of a public office does not bring cases. Travels on the Nile may have resulted in great personal good, but the average office visitor is not particularly interested in learning of the exclusive world trips which the doctor has taken. The certificate represents something valuable, but why post it like a circus lithograph on a bill board? A deed to a quarter section of land is valuable and has a place of public record, if genuine, the same as a certificate of educational accomplishments. Do we often see these deeds framed and hung on the walls to show people that the owner really has a piece of valuable property?

An office, if Webster is correct, is "the place where a particular kind of business or service for others is transacted." An orthodontist's office should be primarily and fundamentally a place of service—and the office appointment should work towards this end. The profession of orthodontia is truly progressive. Why not make the office appointment as progressive as is the profession which it serves?

(To be continued.)

THE HISTORY OF ORTHODONTIA

(Continued from page 284.)

BY BERNHARD WOLF WEINBERGER, D.D.S., NEW YORK CITY.

L. S. PARMLY, in "*Lectures on Natural History and Management of Teeth*" (1820), states that "want of attention during the period of shedding the first teeth and consequent deformity of the mouth are apt to take place."

"In all cases of irregularities, during the shedding of the teeth, the treatment to be observed is to remove the obstructing temporary teeth, and then to apply pressure, in the most convenient manner, upon the irregular tooth, in order to direct it into its proper situation. Where the permanent teeth are large, and the jaw bones have not grown sufficient to admit of their enlargement in a regular manner, they crowd and overlap each other. When the space of the jaw is not sufficient for the regular arrangement of the teeth, some must then be considered superfluous, and it will be necessary to remove one or more of the bicuspids for each side of the jaw before the fangs are formed, (sic) to give room to the test; the incisors must then be gradually forced into their proper places."

"The occasional pressure of the finger and thumb, if attended before the age has given too much firmness to the jaw, will invariably bring the teeth into their proper places, without the necessity of having recourse to continued pressure by means of instruments adapted to the arch of the mouth as recommended by Mr. Fox."

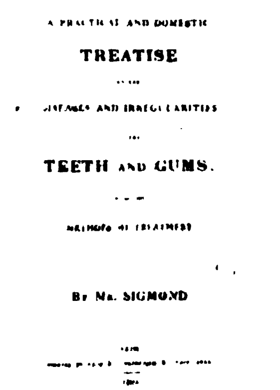
In 1824, *M. Oudet* proved that "When the secondary incisors appeared, they, being larger than those which preceded them, caused an elongation of the alveolar process, proportionate to their excess of volume, and that the first permanent molar is pressed a little backwards; he showed, secondly, that after the eruption of the fourth great molar, the first is again pressed forward into its proper place,

as there is more room, in consequence of the eruption of the second small molars, which is much less in volume than they which preceded it," thus confirming the work of Hunter and Miel.

Mr. Sigmond, in 1825, published his "*Practical and Domestic Treatise of the Diseases and Irregularity of the Teeth and Gums, With the Method of Treatment.*" This was the first work devoted almost exclusively to the subject of irregularities of the teeth.

He attributes irregularities to natural and accidental causes. Natural, (1) when they result from the jaw not expanding sufficiently to allow the teeth to form a regular circle; (2) when they are larger than the ordinary dimensions; (3) when they do not appear in their proper order and place. Accidental, when caused by negligence or improper treatment at the time of their growth.

"The causes of this very striking deformity have not been properly demonstrated by any of the authors on the diseases of the teeth, nor are there any


TREATISE

TEETH AND GUMS.

BY MR. SIGMOND

Fig. 1.—Title page of Sigmond's work, which was one of the first devoted to irregularities of the teeth. Sigmond was one of the pioneers in the use of upper and lower impressions.

directions given to prevent its occurrence; indeed, should the distortion have once taken place, no remedy has been offered, and the case has been always deemed hopeless. It is about the time of the completion of the first teeth that the projecting under jaw gradually begins to show itself, and shortly before the appearance of the second set from the surface of the gum. In communicating my practice to the public, I feel persuaded the simplicity of the remedy, as well as of the cause of the disease, will enable those who may have the care of children, to prevent so serious a deformity. In these cases, at the first commencement, it occurs that one or both of the first eye teeth in the under jaw grow somewhat longer than the rest, and are pointed on the top, so that, in shutting the mouth, the under jaw is prevented from taking its proper direction. The child not being aware of the pernicious consequences, stretches out the lower jaw, attempting in that manner to overcome the difficulty of the free action of the teeth, and constantly is seen in the act of pushing the lower jaw outwards; this

unobserved or neglected at first, grows into a determined habit, and a mischief at first easily controlled, becomes the foundation of this defect; for the jaw gradually lengthens itself out, from the articulation on each side,. to relieve itself from the bad position in which it was placed, and thus the jaw becomes completely underhung."

"The remedy in the very early stage of the deformity is very easy, simple and satisfactory. Those following what I conceive an indispensable line of duty, frequently have their children's teeth examined, and will easily perceive if one or both eye teeth appear a little longer than the rest, and whether they fall in the slightest degree over the upper front teeth. Should this be the case, no time is to be lost, but with a proper file the superfluous part of the eye tooth, or any other of the under teeth, should be gradually reduced, and suitable direction given to the child to attempt to counteract the stretching of the jaw, should the habit in the least have commenced. Many cases constantly are offered to the dentist's inspection, in which it would be advisable, should all circumstances permit, to extract the tooth, which, as it is one of the shedding kind, would be done with little pain and without any inconvenience, particularly when the tooth is loosened, and the filing less easily performed. As the upper teeth should have, when the deformity somewhat advances, a tendency inwards, it becomes necessary, by artificial means, to throw them again outwards which may easily be effected by placing in the hands of the child a piece of hard wood, about four inches in length and a little flattened at the top, desiring the child to occasionally push against the inner surface of the upper front teeth; the piece of wood, properly applied, acts as a lever, and soon forces them into their natural situation. The prevention of mischief is thus completely obtained, and a very short time in the early stage of its appearance will completely stop progress of this unseemly defect."

He described fully the absorption of the roots of the deciduous teeth and the eruption of the secondary set and advised against the dangerous effects of gold wire and silken ligatures of deformed or distorted teeth.

"Notwithstanding the methods of treatment which have been recommended to guard and prevent the deformities and distortion in the growth of young persons' teeth, new cases are frequently brought to me from various parts of the country showing that children's teeth are not sufficiently attended to by parents or friends who ought to feel an interest in giving timely attention. In many instances where deformities and distortion may have been fixed, remedies are invented and brought to perfection, through long practice and experience, which restore them to regular by placing, judiciously, gold plates or shields in such parts of the teeth as will facilitate the object required. In this undertaking a dentist of skill and attention should be consulted, for those friends interested on the part of the patient or the party the time of the operation may take the amount of the expense and its probable result. An attentive examination of the state of the mouth and teeth should be the first object, the age of the patient, whether any of the shedding teeth are still remaining in any part of the upper or under jaws, where new ones will supply their places; and the dentist should decidedly settle his plans which of the teeth should require to be extracted, in order to remove such obstacles as may appear to obstruct the success of his design. Im-

pressions of both upper and under jaws are to be taken, on the plan of my late practice, which always answered the purpose to the utmost of my expectation. Daily and frequent inspection, with attention, is indispensably necessary to regulate or alter the gold plate, as circumstances may direct; and to prevent irritation, to which the gums would be liable during the time of wearing the shield, the constant use of the preservative lotion, made warm, should be attended to till the operation is completed."

Lenord Koecker (1826) states that "Irregularities of the teeth is one of the chief predisposing causes of diseases and never fails even in the most healthy constitutions to destroy, sooner or later, the strongest and best set of teeth unless

Fig. 2.—Use of ligatures by Maury (1828).

properly attended to. It is thus not only a most powerful cause of destruction of the health and beauty of the teeth, but also to the regularity of the features of the face, always producing, though slowly, some irregularity, but frequently the most surprising and disgusting appearance. It is, however, a great pleasure to know that dental surgery is abundantly provided with a remedy, and in most delicate subjects if placed under proper care at an early age, the greater portion of the teeth of the permanent set may invariably be preserved—perfect health and regularity."

As a preventive of irregularity in secondary dentition Koecker recommends the extraction of some of the permanent teeth at an early period in order to

give sufficient room for the rest. "The first molars are generally most predisposed to disease; they are least important as regards both appearance and utility, and so situated as to afford by timely removal sufficient room for the anterior teeth, as well as for the second and third molars. If these teeth be extracted at any period before the age of twelve years, all the anterior teeth will grow more or less backwards and the second and third grinders so much towards the anterior part of the mouth as to fill up almost entirely the vacant spaces caused by the removal of the first molars."

"The deformity which consists in shutting the under incisors and cuspidati over the upper, has been produced by the injudicious extraction of some of the teeth of the upper jaw, without taking proper care to secure a due proportion between the upper and under jaws. We have irregularity also when the temporary teeth are not extracted in time, and when we have too long persistance of the temporary teeth."

G. Waite, "Surgeon-Dentists' Anatomical and Physiological Manual" (1826), states that "Irregularities of the teeth are mostly occasioned by the pressure of the temporary upon the permanent, throwing them in the wrong direction."

F. Maury (1828), in his *"Treatise of the Dental Art,"* advocated the use of ligatures. In describing his method he cautions against the slipping of the silk threads under the gums, which he avoided by fastening the ligatures to a metal in the shape of a small hook, which covered the tooth to be regulated. Another plan was to use a double hook or rings formed in such a manner as to permit one part to be caught over the end of the tooth, while the other end was free to hold strings or wire preventing same from coming in contact and irritating the soft tissues. Later a number of men, among whom was Dr. Farrar, not knowing of this plan, devised a similar method to overcome this same difficulty.

DENTAL PATHOLOGY.—Having spoken of different diseases which manifest themselves at the period of the eruption of the teeth, we shall now occupy ourselves with the examination of the diseases of the dental organs, and to proceed methodically in the classification of their various affections, we will divide them, according to Prof. Marjolin, into three principal sections. Thus in the first, we shall speak especially of the anomalies that they present in their arrangement, and vices of form of the dental arches, having made known the different anomalies that they present in their number and situation. We will examine in the second section the diseases proper to their substance; and in the third, the different affections of the part adjacent to them.

Section 1.—*Arrangement of the Teeth.*—The arrangement of the teeth (M. Marjolin) may present several kinds of irregularities. Some depend solely upon the maldirection of the teeth and others are the effect of an unnatural size of dental arch.

The first of these irregularities is called obliquity of the teeth. and may be anterior, posterior, lateral or rotary. The deciduous teeth scarcely ever present a mal-arrangement, and among the permanents the anterior teeth are more prone to it than the posterior. Several causes produce obliquity of the permanent teeth; such as, for example, a disproportion between their size and the space which they should occupy (plate xi, Fig. I); the protracted molding of some of the deciduous teeth; the presence of any tooth that diminished the space which should be filled by a new tooth; the existence of a supernumerary tooth; and organic diseases of the alveolar ridge. This evil is often announced by the setting on edge or the loosening of an adjoining deciduous or permanent tooth, and the obliquity of a tooth is often occasioned by the position of the other teeth. The dental arch sometimes becomes deformed, and, under certain circumstances, lesions of the tongue and cheek are the result.

The following is the manner by which this vice of dental conformation may be remedied.

When at the commencement of second dentition, there is manifested, anterior or posterior to the inferior or superior cuspidati, a prominence indicating the presence of

the permanent tooth, the deciduous cuspidati should be extracted whether loose or not.* The dentist should attentively inspect the eruption of the second teeth and not extract the deciduous unless he is assured that those of replacement will only have the necessary space for their good arrangement. If it be not well developed, we should extract the first bicuspids, and the teeth, then standing sufficiently apart, will not occasion the decay of each other, but will assume positions adapted to them.

The incisors and the cuspidati frequently assume an oblique position. There are dentists who pay so little regard to the symmetry of the mouth, that they do not hesitate to sacrifice a superior or inferior lateral incisor in order to allow sufficient place of the adjoining teeth to arrange themselves properly, either by efforts of nature, or by the use of ligatures. It would be better to extract in the first instance the two first bicuspids, or only one, according to the exigency of the case, and then place a ligature of raw silk of the proper size around the cuspidatus and attach it to the first molar. The ligature should be renewed daily; and in about two or three weeks the cuspidatus will have occupied the place of the tooth that had been extracted.

We should be very careful in attaching the second bicuspid to the cuspidatus alone; this latter tooth, having the stronger root, the former will be drawn toward it, and the object of the operator will be defeated. When the cuspidatus has been regulated we must bring the lateral incisor into its proper position by the same method. The space between the tooth now to be removed and that to which the ligature is to be attached for this purpose is wider by the distance of a tooth, and thus advantage will be had from the greater contractility of the ligature. The dentist who will reason on this will know the method by which teeth that overlap can be brought into natural position.

When a tooth protrudes from its socket beyond the level of the rest, we employ the ligature to restrain it, but passing it first around the tooth, then over its crown, and finally attaching it around the neighboring teeth in such manner as to produce vertical pressure upon the affected tooth (Plate XI, Fig. 7).

This species of hook has two curves; one is to be applied upon the crown or cutting edge of the tooth; the other reaches very near the neck of the tooth, and is fixed so as to prevent the ligature from slipping nearer than it is desired toward the gums. By means of this little fixture, the ligature then answers better than if its whole pressure was directed upon the root (Plate XI, Figs. 3 to 6). We advise, whenever it is possible, the placing of the ligature upon the molars, because these teeth are better capable of retaining it than the cuspidati which have the form of an inverted cone.

We shall not now speak of partial luxation of the teeth, as a means of replacing them in a more suitable position; this procedure is not always without danger. We will mention, however, that we have greater hopes of success from this operation when performed a short time after the eruption of the deviated teeth, and in a period little more advanced in life, that is to say, from eight to fourteen years. In time, whenever the obliquity of the teeth cannot be remedied, we should, as far as possible, correct the bad effects that may result from its presence. Hence, we may extract those that are too much deformed, or which injure the tongue, the cheek or lips. We may even without inconvenience excise the crowns of some of these teeth, if they cannot be extracted.

The mal-directions that the dental arches may present are, prominence, recession and inversion.

Prominence scarcely ever exists except where the jaws are too narrow to allow of a proper arrangement of the teeth. In such a case, the dental arches are very oblique, and projected anteriorly; they appear very long, and sometimes seem to follow the direction of the teeth (Marjolin). The central incisors are then projected so far forward and are so crowded together that the mouth has more resemblance to that of a beast than to that of a human being.

This mal-disposition of the teeth, of which examples are found among some nations, is sometimes hereditary; but its progress may be arrested by following the procedure which we have proposed; that is, by being particular to extract the (first) right and left biscuspids, and by the application of ligatures so to draw the cuspidati into the place previously occupied by the bicuspids. The four incisors afterwards yield of themselves, and the jaw gradually assumes a more agreeable form. The different metallic plates that are recommended for the correction of this evil, rarely produce favorable re-

*It frequently occurs that the growth of the permanent incisors is more rapid than the destruction of the roots of the temporary teeth, and that the former emerge through the gums behind the latter. In such cases the temporary incisors should also be extracted, and others must be extracted as soon as they appear.

sults; even metallic ligatures are not in such cases as valuable as the silken ones; which are more flexible and more easily adapted. We prefer raw silk or hemp ligatures; and when the teeth are brought to the place we wish them to occupy, we maintain them in that position, by means of a thread of aloes which is soaked for half an hour in hot water. This thread, one of the best ligatures that a dentist can use, distends itself, and in this manner we can employ it without fear of forcing the tooth to take a different direction.

Recession is (continues M. Marjolin) a vice of conformation opposite to the preceding, the anterior teeth are obliquely inward; it occasions deformity, difficulty of pronunciation, premature wearing away of the anterior parts of the teeth, and sometimes even ulceration of the inferior gums, rubbed by the contact of the superior teeth. This requires the filing, more or less, of the cutting edge of the teeth that cause the deformity.

Inversion of the Dental Arches.—When the superior teeth shut within the circle of the inferior, and if even their tubercles are not regularly adapted, they are said to be inverted. The anterior parts of the superior teeth are thus often worn away, while in the natural state the contrary occurs. This want of irregularity in the teeth, which we will call "*menton de vieiliard*" (old man's chin) and not jimber-jaw, may be remedied, particularly in children. Whenever the superior incisors and cuspidati alone shut behind the inferiors, we may bring them forward by means of an inclined plane, invented by M. Catalan in 1808. This instrument consists of a metallic plate attached to the inferior teeth, which projects some lines, and which is inclined in such a manner as to push forward the corresponding superior teeth. We cannot but admire a process so ingenious. In able hands it possesses great advantages; and whenever it can be properly applied, from ten to twenty days are sufficient to establish the teeth in their proper places. We have observed, that, to put this in execution, we should wait at least until the four lateral incisors have entirely come through the gums, in order to offer a sufficient hold to the plate that is to be attached.

Our methods consist in applying a sufficiently large ligature to the two inferior central incisors in such a manner that the tension of the ligature may force them back. When these two are replaced we are in like manner to replace the other two incisors; but if we wish to regulate the cuspidati, and the inferior alveolar border be more developed than the superior, it is necessary, previously, to extract the two first inferior bicuspids; first, to allow the preceding teeth the facility of taking the desired direction, and secondly, not to prevent the lateral incisors from taking their proper situation. There is no need of employing anything to prevent the jaws from closing, as the pressure exercised by the ligatures is sufficient to prevent the inferior jaw from pressing against the superior.

The dental arches, it will be perceived, themselves form a part of the irregularities of which we treat, as, also, do supernumerary teeth.

The various operations appertaining especially to the dental art, and the different instruments proper in their performance.—Among the operations that appertain especially to the dental art, some are intended to facilitate the eruption and regular arrangement of the teeth; others consist in freeing those organs from all injurious influences, and remedying the various influences of which they are the seat, and which may occasion their destruction. We have already, in treating of the means by which we may remedy the evils of first dentition, indicated the procedures of this first class of operations; we shall now enter into the details that this important subject requires, after which we shall treat of operations of the second series. In our examination we shall endeavor to be as concise as possible.

Operations relating to the teeth, and designed to facilitate their eruption.—It has long been thought that the difficulty encountered by the teeth of the first dentition, in rising from the alveoli, depended upon the resistance offered by the gums. Under this impression, after having tried various means to soften them, recourse was necessarily to section of these parts, to give free issue to one or more of these teeth. This operation, seldom practiced, because of the capability of nature to effect the desired object, consists in an incision made upon the gums with an instrument designed for their use. This incision should, in general, be deep, if we would hope for success. The evils that may result from this operation may be subdued by emollient lotions.

Manner of directing second dentition.—Although the deciduous teeth usually assume a good direction, and arrange themselves properly upon the dental arch, as they are developed, this does not always happen with the permanent teeth, which tend to assume a defective position, either on account of the contracted space in the alveolar arch, or on account of its conformation. The permanent incisors and cuspidati are much larger than the teeth that precede them, and have, at their eruption, attained nearly their full size. It

is thought by many that permanent teeth have attained their full size at the time of the protrusion of their crowns through the alveoli. This opinion I deem incorrect, and to demonstrate this we have drawn two large inferior molars taken from the mouth of a child thirteen years old, one of which was extracted a year previous to the other. A comparison of these exhibits a material difference in their size. It is well known that at the period these teeth appear, the jaws have not attained their full size, especially near the alveolar border, which is at this time very narrow. It will, therefore, be perceived that the second teeth do not occupy precisely the same places the deciduous teeth had, but often stand a little to one side of the place the deciduous teeth had occupied, in such a manner that though the latter do not prevent the permanentes from appearing through the gums, they may cause them to take a mal-direction. The permanent teeth being larger than the deciduous, are necessarily more crowded, and arrange themselves with more difficulty.

The first measure to be adopted at the time of the eruption of the permanent teeth, is the removal of the deciduous ones. These teeth may be easily extracted; the fingers will often suffice to perform the operation, but forceps, adapted to the purpose, may with propriety be applied. We should not hesitate to extract such deciduous teeth whenever they may occasion the mal-arrangement of the permanentes. Irregularities that may result from the presence of the deciduous teeth, are always more difficult to correct than to prevent. But we should not be too precipitate in removing the deciduous teeth; first, because in their absence the jaws may contract, especially if the teeth of replacement be long in coming forward; and, secondly, because these teeth have, in some rare instances, been known to endure permanently. In these cases, however, the teeth of first dentition retain their roots entirely. These teeth sometimes remain until old age. The deciduous teeth are sometimes anterior to the permanentes, and at other times they range with them.

It often happens that the permanent teeth are developed more rapidly than the maxilla. The teeth, then, not finding sufficient space, present their lateral sides anteriorly, or are forced within or without the dental arch. In such cases the dentist should act with circumspection, and on observing the maxillary bones to increase without facilitating the regular arrangement of the permanent teeth, he should endeavor to correct their mal-position. Teeth, irregularly arranged, are always unseemly to the view, do not admit of being properly cleaned, and are more disposed to decay on this account.

The best mode of correcting slight irregularities, is to extract one or two to preserve the rest. In this manner, which may at first appear harsh, the teeth being rendered less crowded will be less liable to decay, and having thus plenty of room, will naturally assume a regular arrangement. We may hasten the approximation of the irregular teeth, if necessary, by passing silken ligatures around such of the teeth as should be inclined toward each other.

As it is in general the anterior teeth that are badly arranged, it might be supposed that one of these should be extracted; but the approach of these toward each other would not authorize such procedure for the sake of symmetry. In such cases, according to the example of Garriot, the best practitioners extract one, two, three, or four bicuspids, according to the space required in the anterior arch. We may also extract the cuspidati to effect a handsome arrangement of the teeth, as it is known that these teeth are often irregular. It is, however, not common for us to have recourse to this; first, because their presence is more essential to the symmetry of the mouth than that of the biscuspids, and secondly, because, having stronger roots than the bicuspids, they serve as supporters of the anterior teeth.

If on the contrary, we extract a bicuspid, there will still remain one of the same class, and thus the mouth will not be disfigured; its situation in the middle of each side also permits the teeth to separate from each other with greater facility.

These procedures are always easy, only requiring judgment and skill on the part of the dentist.

Mode of correcting irregularities.—The mal-arrangement of the teeth arises from their inclination inwardly, outwardly, or laterally, or from disorder occasioned by their transposition. We should endeavor to remedy these irregularities by all possible means. Success in such cases will depend entirely upon the intelligence and ingenuity of the practitioner.

In general the means should act slowly, and be continued, without occasioning pain, and, as the teeth that have taken a bad condition, may always be removed with little effort, provided it be persevered in for a sufficient lapse of time, it suffices for accomplishing the desired purpose, to place a ligature around the neck of the deviating tooth, and

then attach this ligature to a tooth at a proper distance from that to be removed. If, for example, we are required to remove a central incisor, situated anterior to the other teeth, we should pass a ligature of proper size around the anterior part of the neck, then bring it around the internal faces of the two cuspidati, and tie around their anterior faces. If the ligature be changed, two or three times a day, and tightened at each time, the adjustment of the tooth can be effected in two weeks at most. The tooth should be retained in its new position for some months by means of a ligature, or, which is better, with a thread of aloes, until the alveolar walls around the tooth shall have attained sufficient solidity to retain it in its place. We employ in this operation small crotchets or hooks, to prevent the ligatures from slipping down on the gums. This mode of regulating the teeth is simple and sure.

Gold or platinum plates have also been used for this purpose, the manner of application of which was somewhat difficult, but this practice has grown into disuse, as it was not always practicable, and the results were not always as prompt and efficient as by the mode already described.

When persons have been unwilling to endure the inconveniences arising from the use of the ligature or plate, an operation still more painful has been resorted to. This consists in luxating the tooth; but this operation should only be performed by an able dentist, since it is not unattended with inconveniences. The vitality of the tooth may not only be destroyed in the operation, the gums lacerated, the alveoloperiosteum injured, and the alveolar processes fractured, but the tooth itself may be broken; and it may happen that he will extract it in spite of every precaution.

CHAPTER IV.

It is, therefore, very essential to know that mal-configuration of the denture may be occasioned: First, by a defect in the conformation of the jaw; Second, by the simple want of their development depending on the health of the individual; Third, by an excess in the dimensions of all the teeth, though the jaws are in other respects well formed; Fourth, by the rapid development of the dentition of one jaw, and the delay in that of the other; Fifth, finally by the too great size of the teeth of one jaw, which do not harmonize with those that are opposite them.

The different configurations, both of the jaw and teeth, are susceptible of many varieties which experience alone can enable us to distinguish.

It appears to me, that it is from not having sufficiently studied these, that so many dentists have adopted a uniformity of practice that savors very much of routine.

I shall not here speak of deviation of the teeth that proceeds from a congenital fault of the jaw. We see that this defect, called hair-lip, by which the palate circle is frequently divided, necessarily carries along with it an irregularity in the arrangement of the teeth; I will only observe, that in the operation which this defect necessitates, the surgeon should have in view, not only re-establishing the continuity of the lip, but also the regulating, as much as he is able, of the dental arch.

Not only one of the jaws may be configured in a various manner, but sometimes both are malformed; the superior is defective in form: 1st. When the alveolar arches are compressed on the sides, and the anterior part is carried much forward. This pre-disposition is frequently accompanied with a deformity of the bones of the nose, which are pinched together, so as to resemble the beak of perroquet. The palate, instead of delineating a perfect arch, presents a sort of triangle somewhat like the arcades of Gothic architecture. This conformation determines the approach of the anterior teeth that are crowded together at the time of their shooting up. I have frequently observed whole families, in which this appeared to be hereditary. 2nd. The palate may be malformed in a contrary manner, and present an arch much flattened and very spacious, but then the arrangement of the teeth will not suffer; for instead of being crowded, they will be separated from each other. I will here again remark, that almost all those that are afflicted with rickets, have good palates, which proves that rickets does not prevent the development of the bones of the jaw, nor of those that are found enclosed in them.

The defects of the inferior jaw are of the same kind; either it is compressed in its lateral parts, and then the anterior teeth are pressed together and placed some before the others; or the circle that it describes is too great, which causes the inferior teeth to come forward, raise the lip, and cross the superior incisors and conoids, by pressing before them whenever the mouth is closed, just like what may be observed in the denture of dogs.

In certain families, this predisposition is frequently hereditary. It is very common

among particular nations, as the Scotch, the English, etc. The mouth indicates it in earliest infancy; it is also the lot of some subjects in whom the general ossification is with difficulty effected, such as children of a very mucous temperament; second dentition, by determining a happy afflux of the osseous juices towards the jaws, sometimes diminishes it, but most frequently increases it.

Thus we see the defects of conformation are more or less decided, and are relative to a faulty development of either of the jaws, or sometimes even of both.

Defects in the configuration of the denture may resemble those in the conformation of the jaw, but the habit of carefully observing, will prevent the surgeon being deceived.

Thus the inferior teeth being too large, or shooting up much sooner than the superior, the rapid increase of the lower jaw allows its incisor to be carried forward.

During this time, the superior jaw has remained inactive, its incisors finally show themselves; but those that meet them from below at each occlusion of the jaws, continually push them towards the concave side of the dental arch: hence results, *either a retracted superior denture, or a projected inferior one,* which, it is very essential to distinguish from that vice of conformation which causes the chin to protrude, so as to resemble a shoe. We may remedy the two former, while it would be dangerous, or at least useless, to attempt to correct the latter.

I thought our attention should the more be fixed upon this subject, as most authors have not sufficiently dwelt upon it; M. Duval has spoken of it, and, though he is too brief on this point, yet he cannot be consulted without interest.

As to the rest, real defects of conformation are of very rare occurrence. The jaws may be very well formed, the palate present a finely rounded arch, the inferior jaw describe an arc of a perfect circle, and the teeth not larger than in the ordinary state; and still they may be irregularly arranged. Here then, is simply a want of development—an organic defect.

In like manner, the jaws may be sufficiently developed, though the teeth are badly arranged; in this case, the superordinary or supernatural size of these small bones occasion the irregularity of the denture. Thus every traction that may be practiced on these organs will be imperfect, unless we previously facilitate their arrangement by the use of the file, if their crowns are too large and their roots of no more than the ordinary size; or by sacrificing one of the teeth, without the range, if the crowns and roots are alike too great.

We shall return to these particular points, when treating of the natural method of arranging a set of teeth at the period of shedding the temporaries.

S. S. Fitch, "System of Dental Surgery" (1829) says, "Irregularity is due to want of simultaneous action between the increase of the permanent teeth and the decrease of the temporary, by the absorption of their fangs to the greatest size of the permanent in comparison with the temporary."

He quotes Fox at great length in regard to the treatment of irregularities and seemingly bases his own practice on the directions there recorded, for he does not make any essential additions to the methods or practice of the older author.

As to this author's advice for the use of the file, he says: "The direction of Mr. Fox to divide and separate the teeth when merely crowded and not carious, has, by its injudicious adoption and indiscriminate performance, been productive probably of more injurious consequences than any mode of practice, or any direction ever given by any writer or practitioner of dental surgery. Almost every dentist who has read Mr. Fox, has adopted and followed this practice. The pernicious consequences of it are seen almost every day."

He has classified malocclusions similar to Fox, which is as follows:

"There are four states of this kind of irregularity. The first, when one central incisor is turned in, and the under teeth come before it, whilst the other central incisor keeps its proper place, standing before the under teeth."

"The second is, when both the incisors are turned in, and go behind the under teeth; but the lateral incisors stand out before the under teeth."

"The third variety is, when the central incisors are placed properly, but the lateral incisors stand very much in; and when the mouth is shut, the under teeth project before them and keep them backward."

"The fourth is, when all the incisors of the upper jaw are turned in, and those of the under jaw shut before them. This is sometimes occasioned by too great a length of the under jaw, in consequence of which it projects considerably forwarder than the upper jaw. But the majority of such cases originate entirely from neglect, and may be completely remedied by early assistance."

"The time to effect any material alteration in the position of the teeth is before thirteen or fourteen years of age, and as much earlier as possible; for after that time the sockets of the teeth acquire a degree of strength, and the teeth are so fixed that they cannot be moved without much difficulty. If the

Fig. 3.—Thos. Bell's conception of occlusion of the teeth (1829).

irregularity be left to a much later period, it becomes a great deal more difficult to produce any alteration, and frequently all attempts are fruitless."

"To remove the kind of irregularity above mentioned, two objects must be accomplished; one, to apply a force which shall act constantly upon the irregular tooth, and bring it forward; the other to remove that obstruction which the under teeth, by coming before the upper, always occasion."

"The first of these objects may be attained by the application of an instrument adapted to the arch of the mouth, which, being attached to some strong teeth on each side, will furnish a fixed point in front, to which a ligature previously fastened on the irregular tooth may be applied, and thus, by occasionally renewing it, a constant pressure is preserved, and the tooth may be drawn forward."

"The second object, that of removing the resistance of the under teeth, must be attained by placing some intervening substance between the teeth of the upper and under jaws, so as to prevent them from completely closing, and be an obstruction to the coming forwards of the irregular tooth."

J. P. Clark, in *"A New System of Treating the Human Teeth"* (1829), states: "Irregularity may arise from too premature extraction of temporary teeth. Disproportion between the teeth and the jaws may be occasioned by a natural conformation of the parts or may be the unnoticed effect of accident, for there are seldom found any such disproportion and consequent irregularity in the teeth of men and animals in a wild state."

In 1829 *Thos. Bell*—*"The Anatomy, Physiology, and Diseases of the Teeth"*—in referring to the correction of irregularities has this to say: "There is not a subject connected with that branch of practice of which the present work professes to treat, which has given rise to such gross charlatanism, or to so much gratuitous cruelty, as that which regards the treatment of irregularities in the permanent teeth. Had I only to lay down the general principles upon which cases of this kind are to be treated, they would occupy but little space for they are few and simple;—but so universally have the practices obtained which I shall have occasion to deprecate (and which must have originated either in the most culpable ignorance, or in motives more disgraceful still than ignorance itself), that some examination of the directions of former authors appears necessary, in order to remove, as far as possible, the erroneous impressions which have thus been made."

"Irregularity, which, in a practical point of view, is only referable to the adult teeth may be considered as either temporary or permanent. There are two kinds of temporary irregularity:—the first occurs from want of concert between the absorption of the temporary and the advance of the permanent teeth, by which the latter are forced into an unnatural position, and come through the gums either before or behind the former; the second arises from the difference in size between the temporary and permanent incisors and cuspids, and is subsequently obviated by the loss of the temporary molars, when succeeded by the bicuspids which are smaller and which consequently allow the necessary increase of room in the front of the mouth. Permanent irregularity originates in the want of exact proportion in the extent of the maxillary arch, and the size of the permanent teeth. That which I have called temporary irregularity also assumes a permanent character when the irregular teeth have remained so long unattended to, as to have become fixed in their unnatural situation or are retained by it, by the pressure of an antagonist tooth in the other jaw. Malformations of the jaw and the occurrence of supernumerary teeth, are also occasional causes of permanent irregularity."

"It were well if the intentions of nature were more attended to in the regulation of the teeth than has generally been the case. In this as in every other circumstance in which surgical treatment is required, it should be recollected that the legitimate object of the surgeon is confined to the application of remedies in diseases, or the regulation of the natural functions when they are deranged, and it is not to be supposed that a process of so much consequence to the comfort and health, and essentially connected with a function so important as that of digestion, should be imperfectly provided for as to be constantly in need of such harsh and unnatural interference. * * * There are other and more important reasons for avoiding the early removal of the deciduous teeth. It will be remembered, that the connection between the temporary tooth and the suc-

ceeding permanent one continues to exist by means of the cord extending from the sac of the latter to the neck of the former, which must be torn through, if the temporary tooth be removed before the sac is absorbed, until, therefore, the secretion of the enamel is perfected which is not the case until a short time before the edge of the tooth passes through the gum, the extraction of the temporary tooth may very probably interfere with the healthy and uniform deposition of this substance."

"There is yet another evil resulting from this empirical mode of treatment which has hitherto been unaccountably overlooked, but which should be impressed on the mind of every practitioner to whom the care of the second dentition is being arranged in a continuous and even series, around the arch of the jaw, tend to preserve its form and even its contracting during the growth of the child, when every part of the body is undergoing continual alteration, in form as well as in size. By the time that these teeth have become loosened, the permanent ones, in their natural course of the change, are ready to fall into their place and thus the correct form of the jaw is preserved, but, if the temporary teeth be removed before the permanent ones are so far advanced as to be ready to occupy their situation the support of the alveolar processes being thus lost, the arch of jaw contracts, and when subsequently the permanent teeth are fully formed there is not room for them to range in their proper situation. Thus the operation which was intended to prevent irregularity becomes the cause of its occurrence and that in its very worst form; producing a great want of accordance between the size of the teeth and that of the jaw."

"A favorable prognosis may, with tolerable certainty, be formed of the ultimate regularity of the teeth, as far as it depends upon the relative proportions between them and the maxillary bones, where the following circumstances are found to exist at the period when the second dentition commences: 1st. If the maxillary arch be well formed, sufficiently expanded, and of a semi-circular form rather than elliptical. 2nd. If the temporary teeth although broad, are a little separated from each other especially if, having been originally somewhat crowded, they have been gradually acquiring more room during the last year or two; as this indicates a disposition in the jaws to expand. 3rd. If the first permanent molars appear to be formed and of moderate size. 4th. If there be no considerable prominence of the gum behind the temporary teeth, indicating that the permanent ones are advancing the situation. 5th. If the parents and family in general especially those whom the child resembles have the maxillary arch broad and well formed and the teeth regularly arranged in proportion to the degree in which these circumstances exist, a more and less regular state of the teeth may be anticipated."

"*Permanent Irregularity.*—The natural periods and order in which the teeth are usually changed, and which have already been detailed are rarely accompanied by any deviation from the regular arrangement either considerable in its degree or permanent in its degree or permanent in its duration provided there be no want of congruity between the size of the teeth and the expansion of the jaw. Now and then, however, when the shedding of any of the temporary teeth has been so much retarded as that the permanent ones are not only forced out of their situation but retained there by the teeth of the other jaw acting upon them

whenever the mouth is closed, irregularity of the very obstinate kind is produced. Still, the most usual cause of permanent irregularity is the actual want of sufficient room in the jaw for the ultimate regular arrangement of the teeth; and this may occur either from disproportionate narrowness of the jaw (whether from original formation, or produced by the too early removal of the temporary teeth), or from preternatural size of the permanent. The former is incomparably the most frequent."

"The principles upon which both the species of irregularity just described are to be treated, are generally similar; the only difference is that their application to those cases in which the jaws close in such a way that the teeth of one prevent those of the other from being brought into their proper place, must be rendered effectual by obviation of the interference, which is to be done either by the actual removal of the interfering tooth, or which is more generally called for by temporarily preventing the mouth from being closed."

Instead of the straight gold bar described by Fox, he advocated the use of one accurately stamped to a brass cast of the upper teeth, "so as to accommodate it to all the depressions and elevations presented by the series of the teeth, except that it should stand a little forward and opposite to the irregular tooth; to such a distance, in fact, as to allow of its being brought quite into its place

Fig. 4.—Appliance and cap devised by Bell.

before it would come into contact with the bar. This method of forming the bar, by fitting it accurately to the arch of the teeth, contributes very much to its firmness and comfort and prevents, in a great measure, its interfering with the lip. It should be so long as to extend just beyond the first bicuspid on each side; two small holes are drilled through it at the part corresponding to each of those teeth—to the irregular one—and, if necessary—to any other to which it may be thought desirable to fasten it for greater security. Ligatures, consisting of strong silk twist, are passed through these holes, the ends of each being brought in front, and the bar is thus fastened, first of all to the bicuspids, and then to the irregular tooth. It is necessary that the ligatures should be applied quite up to the necks of the teeth, or they will slip off, and they should be drawn very tightly, especially that around the irregular tooth. As a part of the bar stands forward from the tooth, and as, although strong, it should be elastic, there will be a constant force acting upon the tooth, tending to bring it forward."

"The closing of the jaws is to be prevented by a method less complicated, and less liable to derangement, as well as firmer and more comfortable to the patient than the one of Fox's. It consists of a simple cap of gold, made to fit very accurately, to a molar tooth either of the upper or lower jaw. I have usually found the former the most eligible. The cap should extend as far as the

neck of the tooth on each side, and should be accurately adapted to all the irregularities of the surface, by being stamped between a brass cast of the tooth and a hollow cast of lead. It is made of gold, containing such a portion of alloy as to render it hard and elastic. When this cap is adjusted, the edges that are adapted to the neck of the tooth are bent a little inwards, so that some force is required to press them over the convexity of the crown; they will then spring into the depression at the neck, and the cap will remain perfectly firm in its situation, if accurately made and properly applied. The thickness of the surface must be sufficient to prevent the lower front teeth from interfering with the operation of bringing the irregular upper one forward, by means of the bar."

"The ligatures should be replaced about every other day, and the bar should be wholly removed whenever this is done, in order to cleanse it; as otherwise it becomes offensive and irritates the edges of the gum."

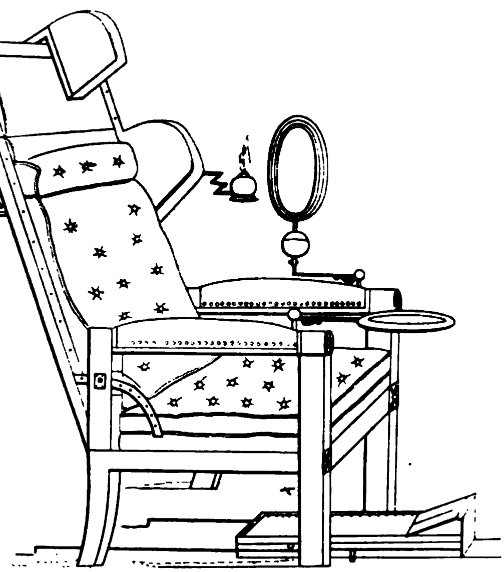


Fig. 5.—One of the first designs of operating chair, used by James Snell in 1831.

Early treatment is advocated and should be begun before the twelfth year or earlier. His work contains many illustrations, including excellent drawings of the jaws and teeth, in normal articulation, with the cusps interlocking.

Jos. Harris (1830)—*"A Familiar Treatise on the Teeth,"* and *John Winckworth* (1831)—*"On the Teeth,"* both attribute irregularity of the teeth to supernumeraries.

Leszai (1830) described, in the first half of his work, *"Die Dentition Anatomisch Physiologisch und Pathologist Betrachet—,"* the development of the dental arches and first dentition. The second part treats of the growth of the arches, in which he discusses the treatment for irregularities. There is little that is new, his work being mostly a repetition of the thoughts of his predecessors. However, he clearly outlines normal articulation, or what would now be considered occlusion.

John Nicholles (1833)—*"The Teeth, in Relation to Beauty, Voice and*

Health." "It has been asserted by many writers that by retaining the two lateral temporary incisors we shall contribute to the expansion of the jaw; this I deny; and, if ever I recommend that they should be retained, it is when the new set being small, expansion is not required because there is no danger of lateral pressure."

"A recent author of considerable talents has mistakingly affirmed, that the temporary set should by no means be extracted until the new teeth are ready to take the place of the old. It is hardly necessary to show the fallacy of such an opinion, when it is considered that the natural and proper circle, formed by the adult teeth, is many degrees more expanded than that which contained the temporary set."

"Shortly afterwards a similar process goes on in the upper jaw; the central temporary incisors become loose, giving token of the speedy appearance of the permanent teeth, and, as a general rule, the safest practice is to extract the four temporary incisors."

"In a few months subsequently to the central permanent incisors having taken their proper place, it becomes of the utmost importance to attend to the forthcoming lateral incisors of the lower jaw; shortly afterwards, and, in many cases, at the same time, the lateral incisors of the upper jaw appear. To make room for their proper development, it is requisite to remove the fifth and sixth teeth,—that is, the two temporary cuspidati in each jaw, when the child, as far as the four permanent front teeth in each jaw are concerned, may be considered to be in a state of perfect safety. No deformity in their arrangement can now take place, unless arising from some malformation of the teeth or of the jaw, entirely beyond the previous control of the dentist."

"It is now that the result of the past attention will make itself visible, and in the most pleasing and palpable form. The mouth, certainly not the least important feature of the face, will gradually mold itself into harmony; the teeth will be beautiful from their regularity; and the chin, though in a less degree, will be acted upon by the same influence. Indeed the change that takes place under these circumstances is so great, that I can hardly expect it will be credited in its whole extent by those who have not witnessed it. With this conviction, I abstain from saying all that my own experience would warrant me in advancing, but I must be allowed to repeat that inattention to the teeth at this critical period may be destructive not only of beauty but even of the health itself."

"It should, however, be considered as an established rule, that the projecting cuspidati themselves should never be extracted, unless when the deformity has been allowed to extend to their full development, and is consequently irremediable. In such cases we must, as the least of evils, consent to their extraction, both on account of the hideous appearance, and in order to get rid of the pressure, which else would infallibly produce caries upon the other teeth."

"The evils, however, attendant upon this decision, and it would be wrong to conceal them, are really great. The beauty and character of the countenance are materially affected by it."

"With regard to the correction of deformities, it is unnecessary to point out the numerous mechanical contrivances for this purpose, nor would they be understood without the help of plates. My readers, however, may rest satisfied

that deformities of every kind are to be remedied, and that success is not confined to a very early age, as has been asserted by most writers on the subject. I speak positively, for I speak from experience, having succeeded with patients even after their twenty-fifth year, and that too in cases which had been previously pronounced beyond the power of art to remedy."

"Before I conclude this division of my subject, there is one point to which I am particularly anxious to call the attention of my readers, the practice being so general and the mischief consequent upon it so great and so inevitable; it regards the use of ligatures or wires—never on any account allow them to be fastened round the new teeth in the application of the mechanical means to correct deformity; let the operator say what he will, the result must be their destruction."

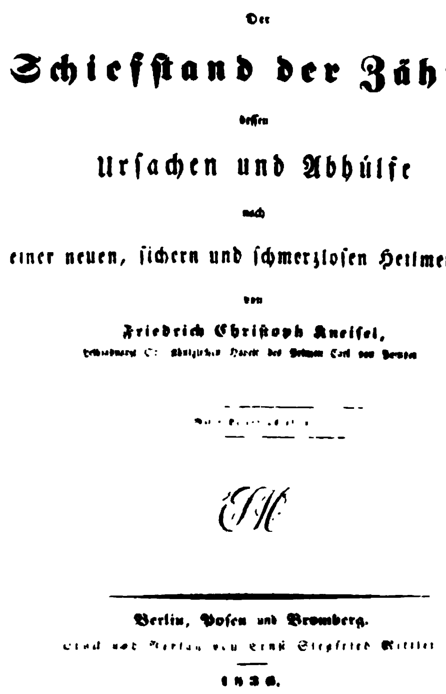
Fig. 6.—Appliance devised by Wm. Robertson in 1834 for correction of irregularities of the teeth.

David Jobson (1834)—*"On the Teeth."* "Irregularity is due to the smallness of maxillary arch and great size of permanent teeth and their situation, part on inner and of others on outer side of temporary teeth."

He advocates preserving the teeth as long as possible, seldom extracts, and in general follows Hunter's method. It is interesting to note his statement regarding the first molars,—they being rarely irregular and almost always assuming a normal position. He also states that the treatment of all cases should be before the patient reaches his thirteenth year (which is contrary to Hunter and others) as the roots of the teeth are then formed and difficult to move. In treating irregularities, he claims that a crowded condition of these organs will take place in those cases where their dimension exceeds those of the jaw, notwithstanding every care of the dentist.

Wm. Imrie (1834)—*"Parents' Dental Guide."* "Irregularity is due to the want of development of jaw-bone. Thumb sucking, intemperance of various kinds combined with artificial modes of living introduced by civilization and sudden transition from heat to cold to which the teeth are subject—all these have a tendency to prevent the development of the bones—a similar state of the teeth and jaw-bones is induced when attempts are made by the inexperienced to regulate them by the extraction of teeth of the upper jaw and neglecting to remove an equal number in the lower."

Wm. Robertson (1835) in his work, *"A Practical Treatise on the Diseases of the Teeth,"* does not add anything of importance to the correction of irregularities of the teeth, although he devised an appliance, based upon the inclined plane, that varied greatly from those of his predecessors.


Der

Schiefstand der Zähne,

dessen

Ursachen und Abhülfe

nach

einer neuen, sichern und schmerzlosen Heilmethode

von

Friedrich Christoph Kneisel,

Berlin, Posen und Bromberg.

1836.

Fig. 7.—Title page of F. C. Kneisel's work (1836).

Fig. 1 represents one of the central incisors of the upper jaw shutting within those of the lower.

Fig. 2 shows the method by which this deformity is remedied. A gold plate is accurately fitted and firmly secured to the lower range of teeth; it inclines inwardly across the cutting edges of the teeth which inclose the upper incisor. In shutting the mouth the posterior surface of the irregular tooth acts against the inclined surface of the plate, and by the pressure thus produced the tooth is gradually moved forward into its proper situation. The plate at both ends encloses and rests upon the grinding surfaces of the bicuspids which bear it up

against the pressure of the irregular tooth, and prevents the lower edge of the plate from being forced against the gums. The same principle is adopted whether there are two or more of the upper teeth shutting within those of the lower jaw.

Fig. 3 is a view of the plate separated from the teeth.

Fig. 4 is a plate adapted for two front incisors similarly situated to the one described. In this case the bicuspids have not yet made their appearance; it therefore becomes necessary to support the plate against the molar teeth, and to prevent the lower edge of the plate in front from pressing against the gums. It is also supported against the cutting edge of the lower incisors.

John Mallan (1836)—*"Practical Observations on Physiology and Diseases of the Teeth,"* remarks that as the adult teeth are larger as well as more numerous than the milk teeth, it is obvious that they require a great deal more room, and when absorption of the latter does not progress equally with the growth of the former, the new teeth are crowded and are apt to be forced out of their natural position by the resistance of the old. Again, if the permanent prove, as they sometimes do, disproportionately large in comparison with their predecessors, the jaw may not be sufficiently extended to admit of their being arranged in order, in which case some overlap the others and considerable deformity is occasioned."

F. C. Kniesel, in 1836, published his book, *"Der Schief stand der Zahne"*—the first special work in the German language devoted to malocclusion of the teeth.

In this work, we find the beginning of the series of classifications which followed in rapid succession. According to Kniesel, the anomalies of the teeth were classified in two groups, partial and general. The first dealt with malposition of individual teeth and the second with the malrelation of the arches.

We here find the first application of the chin cap as used until recently in orthodontia, and perhaps for the first time an attempt at making and using a removable appliance.

We also find in Kniesel's work the introduction of another important factor into dentistry and one that had the greatest influence in furthering the development of orthodontia, namely, the use of plaster models.

In the section devoted to treatment, we find the first attempt at making metal dies and counter dies, and the introduction into prosthetic dentistry of another material beside wax and plaster of Paris. Kniesel described in detail this system which is closely adhered to today. Bell's method was, as already described, different.

Having found this work so interesting, and believing that it will prove so to the readers, I decided to incorporate the whole in this history.

INTRODUCTION.

Of all the deformities which disfigure the beauty of the human countenance, which hinder in the harmony of enunciation of speech and song, which influence health and interfere with one's vocation, there is none so significant as the adverse position of the teeth. All features and characteristics may be ever so beautiful and perfect, yet a charming appearance is very often marred by distorted teeth.

These important facts are, however, often overlooked, although they deserve consideration; as experience teaches daily, that, until very recently, one troubled oneself very little about the causes of distortion, and the various ways of correction.

How many cases are there of a very beautiful face being spoiled by distorted teeth, which cause lips to protrude and which interfere with the closing of the mouth.

A very interesting case of this kind came to my attention recently. It deals with a 12-year-old boy, whose eye teeth projected outward so far that they pushed the upper lip away to one side. The four incisors were so far backward that the entire row of lower teeth rested beyond them in biting, whereby the face of the boy was so disfigured that the chin projected outward entirely too far and approached the nose, the upper lip was flattened in the middle, the region of the cheeks was swollen in appearance, and the space between the eyelids was made narrow.

Plate II, Fig. 1, [Fig. 8], shows this face with distorted teeth, and Plate II, Fig. 2, [Fig. 8], the same after I extracted the two eye teeth and brought the four incisors outward. The improvement in this child's face was so remarkable that his father did not recognize him readily.

My practice allows me the opportunity of observing all kinds of anomalies in the positions of teeth.

The aim of this work is to arouse the attention of parents to the importance of correcting the teeth and secondly, to make my method common to all.

CHAPTER I.

Distortion of the Teeth.

1. *Regular Position of the Teeth.*—The mouth of a human being consists of thirty-two teeth, arranged in two semi-circles, each containing sixteen teeth, and shaped in such a way that—

1. When biting (by putting strips of paper between the back teeth) the front part of the upper row of teeth should project from ¼-½ over and in front of the lower row.

Fig. 8.

2. The crowns of the lower incisors lie against the somewhat concave inner surface of the upper incisors.

3. The remaining eight back-teeth rest perpendicularly upon one another on both sides; these positions are made clear on Plate III, Figs. 3, 4, 5, 6, [Fig. 9], where a side and front view show the position of the teeth.

In all individuals, whose teeth are in the position of the above order, distortion of teeth is impossible.

2. *Irregular Position of Teeth.*—The irregular position of the teeth, which one understands under this heading, generally occurs to the sixteen front teeth, generally to the eight upper teeth, whose deciduous ones (by nature) did not stand perpendicular to one another. Irregularity is seldom noticed among the sixteen back teeth, which are perpen-

Fig. 9.

Fig. 10.

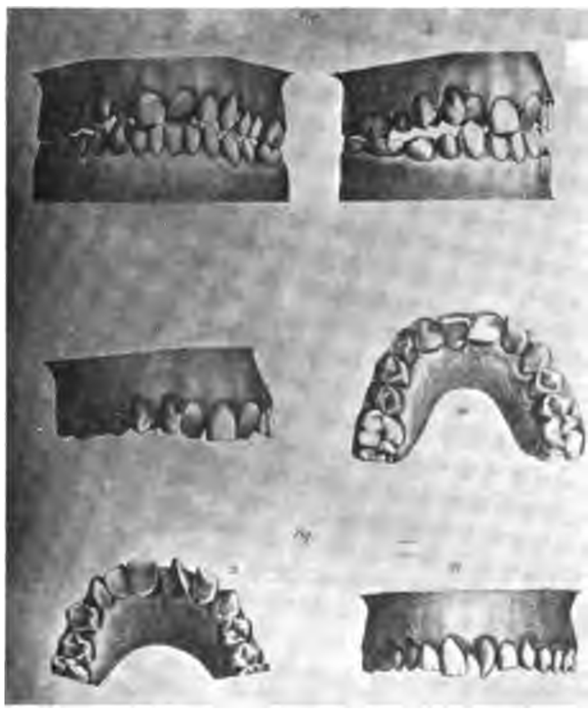


Fig. 11.

dicular to each other. Therefore, all teeth that are without the half circle, or which project inward, and are in an oblique or crossing position, are said to be in an irregular or distorted position.

(*A*) *General Distortion.*—The following are the most causes:

1. Where the upper row of teeth project outward.

2. Where the lower row project beyond the upper row of teeth. (Plate III, Figs. 7, 8, 9.) [Fig. 9.]

3. Where both rows of teeth are perpendicular to one another. (Plate IV, Figs. 10, 11, 12.) [Fig. 10.]

To this class belongs also the peculiar case of both rows of teeth being in a distorted position, both being turned inwardly upon one another. (Plate IV, Figs. 13, 14.) [Fig. 10.]

(*B*) *Partial Distortion.*—The following are to be classed among the above heading:

1. Where single teeth of either jaw are out of position. (Plate IV, Figs. 15, 16.) [Fig. 10.]

2. Where single teeth project inward or outward. (Plate V, Figs. 17, 18, 19, 20.) [Fig. 11.]

3. Where single teeth appear to be turned. (Plate V, Figs. 21, 22.) [Fig. 11.]

CHAPTER II.

ABOUT THE CAUSES OF DISTORTION AND THE TREATMENT.

Among the main causes, which are at the bottom of this deformity, the most important one, it appears to me, is the abnormal growth and position of the jaws, especially

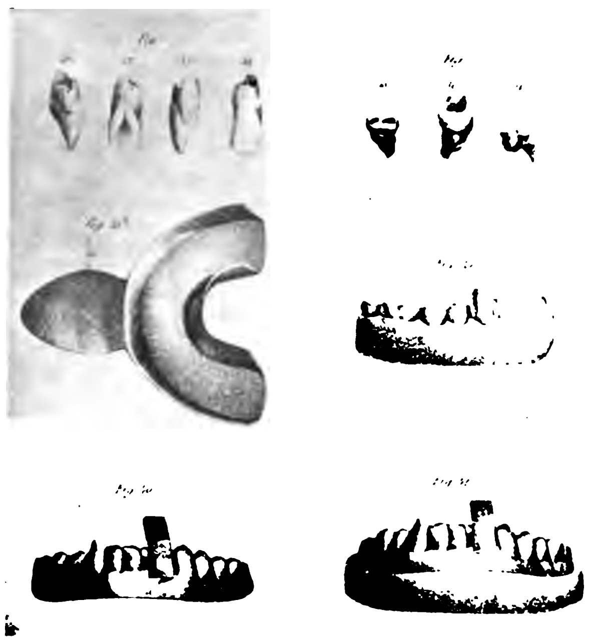


Fig. 12.

the teeth *progression;* this is often transmitted from one generation to another. Therefore, the matter of teeth should be looked after from the time of birth. After the beginning of teething, and after the front teeth are grown, it is useful to give a child some sort of elastic to nibble and bite at, by means of which the regular growth and development of the jaws and the correct position of the teeth are brought about. If the child is grown enough, it is well to give it a piece of hard bread to nibble at. The neglect of this caution is very disadvantageous for the correct position of the teeth. Also the neglect of the second teeth is a cause for distorted teeth. During the time of the second dentition, between the ages of seven to fourteen, and sometimes later, great care must be taken for the timely extraction of the deciduous teeth. The extraction must also not be done too soon or without prudence, because one runs the risk of allowing the second teeth to erupt

too soon, and thereby injuring the proper development and stretching of the alveoli. (Plate VI, Figs. 25, 26.)

The causes of distorted teeth are often the irregular, narrow space of the jaws, unusual width of the teeth, too great development of the teeth and other similar causes. (Plate VI, Figs. 27, 28, 29, 30.)

CHAPTER III.

Determination of Age, by Which the Regulation of Distorted Teeth Can Be Brought About.

In order to regulate irregular or distorted teeth, one must understand what course of procedure to take in order to bring the teeth into perfect line and in good position. As this can only take place under certain conditions, and can only come about through a certain fixedness of the teeth, this operation can only be successful at a certain age, and especially only where,—

1. The "roots" of the teeth are still wide open and are not quite closed at the apex, which allows for development at the end of the teeth and space for the nerves. (Plate VII, Figs. 31, 32, 33, 34.) [Fig. 12.]
2. Where the alveoli are not completely hardened and inflexible.
3. Where the teeth have the necessary pressure, and have reached such a fixedness, that they could be moved properly and without injury, with the root, otherwise the root would remain in the old position, as I have often observed. (Plate VII, Figs. 35, 36, 37.) [Fig. 12.] Therefore, it is very necessary that the age be taken into consideration.

In this respect I have found that the regulation of a tooth is most practical the second year after its eruption; one should always let the time for regulation be judged by the dentist, since it is sometimes advisable not to begin regulation too soon. But the most favorable age is from eight to sixteen.

Indeed, this operation is also advisable after the age of sixteen, although it is more difficult and takes a longer time. Yet they should not be regulated too late in life as there is great danger of permanently loosening them.

CHAPTER IV.

About the Old Ways of Regulating Distorted Teeth.

Until now there was really one method,—to be exact, two; for both depended upon loosening and pressure of the distorted teeth. The one is obtained little by little, the other at one time. In one, one uses ligatures of twine and silk, besmeared either with or without the "Capal?" of the pine tree, also called "Fite?", or crines de florence; or of silver or platinum wire. This method, with its variations is recommended by Geraudly, Hunter, Brunner and others.

For the second treatment, Fauchard's method is made use of. The tooth is quickly loosened, brought into its proper place and is fastened there with a silver wire.

Both methods are of great value on account of the number of years they have been in practice.

An adjourning tooth or several of them must serve as a fulcrum, for the turned tooth. By this means, the pressure of the ligature is divided evenly in an entire circle, then, according to the laws of the mechanics, the tooth that serves as a fulcrum is pushed just as much out of its position, as the distorted tooth. Furthermore, the knotting of the ligatures is accomplished with difficulty and pain; they slide off easily and must be tied anew; they press down onto the roots of the teeth, separate the gums from the teeth, and allow the teeth to be lifted out of their cavities, making them loose, painful and easy to fall out.

The loosening of the teeth with the pelican is a very painful operation, and if one does not understand it, he is liable to cause the tooth to be broken or if successful in bringing the tooth to the desired position, it will probably not long remain there. I have tried both methods, have found them not suitable to my purpose and unworthy, therefore I had to reach my end by different means, where I had the opportunity of discovering other methods.

CHAPTER V.

New Method of Correcting Irregularities of the Teeth.

My method of correcting irregularities of the teeth consists in the application of a spring of 14-carat gold, with a silver or gold crown. This method until now, entirely un-

known to others, and peculiar unto myself, is used when correcting the upper anterior teeth, by being applied to the lower front teeth. This appliance was made and applied in my own way, and to accomplish this the following instructions are necessary:

1. The form (impression) of the teeth and the alveolar portion is obtained by means of a wax composition, on which the metal appliance is allowed to lay.
2. This impression is then modeled in sulphur.
3. A model of plaster of paris is obtained from the sulphur model.
4. A model (die) of a metal composition, of the above mentioned parts of the jaws, is molded in the above plaster of paris mold.
5. Out of the same metal composition, a cover (counter die) is completed, and this constitutes the "stamper," the metal that is to be swaged is thus shaped therein.

The impression of the teeth described under number one is obtained by the use of a form (tray) of tin, horseshoe in shape, on the bow of which a handle is attached for the convenience of handling. (Plate VII, Fig. 38.) [Fig. 12.] A piece of wax paste is laid therein this wax composition is made as follows: Eleven and one-half ounces of yellow wax, 2¼ ounces of resin, 1¼ ounces of poppy oil, ½ ounce of alkanna root, 1 scruple of bergemott oil, prepared scientifically. This wax paste is laid, according to length, thickness and breadth, over the eight to ten anterior teeth and continuing back to the remaining teeth included in the jaw.

In order that an impression of the teeth might be obtained, the impression tray, with the wax, is inverted, and placed so that the occlusal surfaces strike the center of the wax at every point. The mouth should not be opened too wide. Begin at one corner of the mouth, thus with an even pressure, press both arms of the tray with the index finger over the teeth and alveolar portion. To be sure that this is complete it is safer to press the overflow with the index finger, in order to obtain all of the alveolar portion.

When one is certain that the impression is complete, remove carefully the tray from the teeth; as a rule this presents little difficulty as the moisture of the teeth and gums prevents the wax parts from adhering.

Having thus obtained the impression of the teeth, the open ends may be closed by the addition of new wax. Then fill with sulphur, first stirring before pouring, and allow to cool and crystallize. This constitutes the sulphur model mentioned under number two. (Plate VII, Fig. 39.) [Fig. 12.]

As the sulphur model does not have the necessary hardness, over which a silver cap can be formed, it is necessary to make one of metal; consequently one of plaster of paris must first be obtained. To do this separate the sulphur model, which has been chilled, carefully from the wax impression. Fill in the hollows (air spaces) with wax paste and paint the whole with almond oil, in order that it may be more easily separated from the plaster impressions. A two-and-a-half inch strip of stiff paper is then laid around the base of the sulphur model with wire or thread. The space between the model and the paper is then filled in with the wax paste, in order to make it water tight. Then pour into this paper shell, and over the sulphur model, a mixture of plaster of paris and water, which has been stirred and has become a paste.

When the plaster has hardened and fully dried, this can be helped along by artificial warmth, remove the surrounding paper from the finished plaster model, and separate same carefully from the underlying sulphur model. With this plaster impression, number three, proceed as in the sulphur model, first placing a strip of paper as before described, and then pour into the plaster impression sufficient metal that has been melted. This metal composition consists of twelve parts of bismuth, three parts zinc and three parts lead. As this metal slowly cools and hardens, it cannot be removed from the plaster until approximately one-quarter of an hour has elapsed, and metal model number four is thus obtained.

A counterpart or cover, number five, in conjunction with this metal model, is necessary in order to complete this afore-mentioned "stamper." In order to do this, light a piece of pine wood, hold the metal model over the lighted flame, and allow a thin layer of soot to adhere over the outer surface of same. This will prevent the cover from adhering or becoming attached to the metal model.

Instead of coating the model with soot, the model can also be thinly coated with a paste of chalk and water, by means of a camel's hair brush, or with a thin separating fluid which oxidizes the metal. When this is done, the metal model is also surrounded with paper as in the plaster model, and pour into this sufficient of the above described melted metal composition, and complete the counterpart; this must not be removed however until fully cooled.

If it is desired to ascertain the size of the finished silver or golden appliance, take a piece of tin foil of the proper size, lay this on the metal die, place the counter die over same and by means of the hand, press a number of times; thus obtaining the foil crown. This is then smoothened, and from this a pattern of the necessary quantity of silver or gold leaf is cut. The latter is then laid in a like manner on the metal die, bend the cap to shape, and back into place. Drive this, by means of a hammer, into the redress of the counter die, pounding until this has been forced into place. The open ends are then rounded and contoured inward, so as not to touch the tongue or the lips. The above described appliance is then placed on the lower teeth, for example, like one puts on a hat, and allowed to touch the upper teeth that are irregular, and the patient bites on a piece of paper that has been laid between the back teeth, in order to determine where the pressure should be, and where the spring must be placed on the appliance. When this has been ascertained the gold spring is soldered on; this spring can be tempered, by hammering, when necessary. Then place the finished appliance (see Plate VII, Fig. 40) on the lower teeth

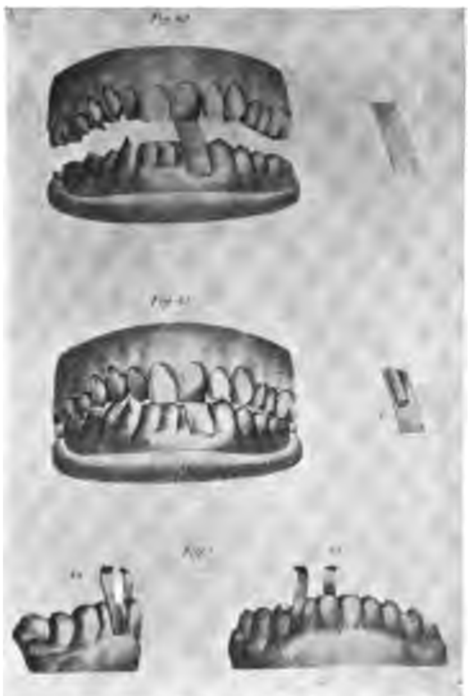


Fig. 13.

(Plate VII, Fig. 41). Allow the teeth to come together, and adjust the spring to such a position against the broad surface of the tooth, so that the irregular teeth may be moved in or out according to your desire. Then increase the pressure on the spring so as to prevent the teeth from coming together. Plate VIII, Fig. 42). [Fig. 13.] When the spring is given the proper position and proper amount of pressure, and the application of the appliance is thus obtained, the patient is directed to keep the teeth closed as much as possible, so that the pressure of the spring against the teeth might work continuously, thereby allowing the object to be obtained as quickly as possible. Young children should also be directed particularly at night to apply a cap of linen, with ear laps, from the chin to the head, in order to force the lower jaw against the upper. Thus the mouth cannot be opened while the patient is asleep and the appliance cannot be moved or swallowed.

After the apparatus has been applied for twenty-four hours and the irregular teeth have been moved sufficiently from their wrong position, the spring no longer presses against the teeth, consequently the jaws can be brought together (Plate VIII, Fig. 43), which in the original they were unable to do. Therefore it is necessary every twenty-four hours

to readjust the spring until the teeth are in their proper position. This is done by bending or moving the spring, or by soldering on lengthwise a small additional strip. (Plate VIII, Fig. 43.) Thus additional strength and tension is obtained. The same method is followed in straightening the teeth in the lower jaw, with the only change that the appliance is adjusted to the teeth of the upper jaw. If there are several irregular teeth in the jaw to be straightened, it is advisable to proceed, one at a time, in regular order, thus making it possible to obtain a greater pressure in the proper direction than in endeavoring to straighten a number at one time. If the spacing between the teeth is very close and thereby hindering the correction and placing of a tooth in its proper place, use the file or extract one of the teeth, whichever is most feasible or aids towards beauty.

There are some dentists who do not consider the extraction of the much dreaded eye tooth as being necessary, on account of the absolute need of these teeth in holding the anterior ones in their position, their use as props, and as they prevent the adjourning back teeth from drifting forward and closing up the spaces. For these reasons, therefore, they cannot be spared. However, the eye tooth, if not extracted prevents the straightening and placing of the incisors teeth in their proper position, through their pressure against the incisors. This should be considered more essential than to allow these teeth (canines) to remain, as they may ultimately be lost through decay and caries.

Finally in order to straighten and place in proper position those teeth which have rotated, I use a cap with two springs placed in opposite directions. One for pressing the other for pushing the tooth into its position, this grasps the tooth as though in a fork-like vise, causing the tooth to be turned around. (Plate VIII, Figs. 44, 45.)

I recommend that during the entire time of treatment the patient should be kept quiet, should partake of food that is easily digested, preferably in liquid form, as soft mush, cold soups, comports and the like. Cooling drinks, water with or without sugar, orangeade, lemonade, etc. In order that all food and drink may be indulged in, I also permit the removal of the appliance from the mouth.

In following the above described procedure, correcting the teeth, as a rule, should be accomplished in the following length of time:

1st. 8-9 years—6 days .
2nd. 9-10 years—12 days.
3rd. 10-13 years—36 days.
4th. 13-14 years—6-8 months.

Shearjashut Spooner, in his *"Guide to Sound Teeth"* (1836), says: "To remedy many cases of irregularities it is necessary to have recourse to gold or silver plates, or other mechanical contrivances. When the front teeth stand too far asunder, from natural conformation or from too early extraction of the temporary teeth, they may readily be brought so as to exert a gentle but continued pressure."

(To be continued.)

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

James David McCoy, D.D.S., Editor,
Los Angeles, Calif.

THE NATURE OF THE X-RAY AND ITS DISCOVERY

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In order to gain an intelligent conception of the x-ray it is quite necessary that the student start with a consideration of certain phases of electro-physics, and radiant energy, or in fact the very foundation of matter itself.

According to the most plausible theories and beliefs, all matter is suspended or contained in the medium known as ether, which is an elastic medium filling all space, interatomic and interelectronic, as well as all other space of which we have any knowledge.

Furthermore, many facts brought out by the close study of chemistry and physics seem to justify the belief that all substances of matter are composed of minute particles called molecules, and that each molecule is made up of two or more elements called atoms, while these atoms are also further divided in particles known as electrons.

These electrons or units of matter are never still, but are in a constant state of motion or vibration, each substance having its own specific atom and the electrons of such atoms having their own rate of vibration.

The vibration of these electrons produce disturbances in the ether known as "ether waves" which vary in length according to the rate at which electrons are vibrating. If the rate of vibration of the electrons be changed or disturbed, there is a change in the ether waves, resulting in a corresponding change in the phenomenon produced.

If this theory of matter is correct, as the evidence of modern science would lead us to believe, all matter then is made up of the same constituents, and its various forms are determined not by any essential difference of composition, but by the number, arrangement and amount of motion of the ultimate particles making up the atom.

All this has a practical significance to us in understanding the phenomenon which we call the x-ray. As stated before, it is known that a certain rate of vibration of electrons will produce other waves resulting in a definite phenomenon, while a change in this rate will produce an entirely different phenomenon. For instance, a slow rate of vibration (75,000,000 per second) produces what are

known as electro-magnetic waves. A little higher up the scale where the electrons are made to vibrate faster, heat waves appear. Another increase and light waves appear. If we continue to accelerate the rate of vibrations of the electrons, there will be produced successively ultra-violet or Finsen rays; then cathode or radium rays, and finally the x-ray.

It will then be seen that the x-rays are produced as the result of the most rapid rate of vibration of which we have any knowledge. In the laboratory this phenomenon is produced by the sudden stopping of a stream of rapidly moving free electrons in a vacuum tube which has been exhausted to one millionth of an atmosphere.

The x-ray therefore may be defined as that form of radiation which emanates

Fig. 1.—William Conrad Röntgen.

from a highly exhausted tube when an electric current of high tension is passed through the tube. The object of the vacuum tube is to establish a medium in which all source of resistance is removed, so that the electric current may excite the exquisitely rapid vibrations necessary to produce the phenomenon desired, the electric current being the source of excitation.

The radiation thus produced gives neither heat nor light, nor can it be deflected, reflected, or polarized. In fact, it can only be recognized by its effect upon the photographic plate and upon such chemicals as Willemite, Calcium, and Tungstate, which floresce or glow under its influence.

The x-ray was discovered in 1895 by William Conrad Röntgen, Professor of Physics, at the Royal University of Würzburg, in Germany. This discovery marking as it did a distinct epoch in the Science of Medicine, was received by the world with incredulity and amazement, for its reported possibilities savored almost of the occult. "A new ray had been discovered by means of which it was possible to look through opaque substances."

While it fell to the lot of Prof. Röntgen to make this discovery, there is no doubt but what other experimenters in the field of physics, unconsciously produced this same ray. In fact, its discovery was made possible by the work of other scientists who preceded Röntgen and laid the foundation for its advent.

Fig. 2.—Michael Faraday.

Of these Michael Faraday was the pioneer. In 1831 he discovered electric magnetic induction, which made possible the induction coil and the other electrical machines utilized to generate currents of great potential. As early as 1838 he conducted a series of experiments to determine the effect of electrical discharges upon rarified gases, and invented the terms "anode" and "cathode" for positive and negative electrodes.

In 1858 Geissler constructed the first vacuum tubes and it was noted at this time that an electrical discharge passed through these tubes would produce a peculiar glow or phosphorescence, the coloring of which depended upon the character of the rarified gas contained in the tube. This phenomenon became known as "florescence."

A few years later (1860) Prof. Hittoff, a celebrated physicist of Munster. conceived the idea of exhausting the Geissler tube to a higher degree of vacuum and found as a result an increased resistance to the passing of the electrical discharge, and that the color of the rarified gases under florescence, varied with the degree of rarification. He also discovered another fact which was to have an important bearing upon the work of later experimenters, and that was that the luminous discharge in a Geissler tube, ***could be deflected by a magnet.***

The important work of these early experimenters was followed later (1878) by Sir William Crookes, who succeeded in constructing a more perfect vacuum tube, that is, one which could be exhausted to a much higher degree of vacuum. With these improved tubes, Crookes discovered that with a sufficiently high vacuum the luminous glow within the tube disappeared, and demonstrated that within it there was a rectilinear radiation from the cathode, which he conceived

Fig. 3.—Sir William Crookes.

as being a projection of particles of highly attenuated gas at exceedingly high velocity. To this radiation he gave the name "Cathode Rays," and because of the peculiar behavior of gas in this exceedingly rarified state, he concluded that it was as different from gas in its properties as ordinary air or gas is different from a liquid. He found that the impact of the cathode rays against the wall of the tube would produce within it a greenish "phosphorescence" or "florescence" and an increase in temperature; also that these rays could be intercepted by metallic plates within the tube. By concentrating the rays at the focus of a concave cathode, he was able to produce a brilliant florescence and a very high temperature, both at the walls of the tube and in various substances within it. Without doubt, Sir William Crookes unconsciously produced the x-ray in the course of these experiments.

In 1892 Prof. Heinrich Hertz discovered that cathode rays would pene-

trate gold leaf and other thin sheets of metal placed within the tube. Soon after this discovery, Hertz died, and his experiments were continued by his assistant, Lenard, who was able to demonstrate that many of the phenomena of the cathode rays could be observed outside of the Crookes tube. By closing a vacuum tube at the end opposite the cathode with a thin sheet of aluminum, he demonstrated that a radiation proceeded through or from the aluminum walls of the tube which would pass through many substances opaque to ordinary light, and after passing through such substances, it would excite florescence in crystals of barium platino-cyanide, and would effect sensitive photographic plates in much the same manner as ordinary light. Lenard considered that all these phenomena were due to the cathode rays alone although in the light of our present knowledge, there is no doubt that not only in his experiments but in those of Crookes, Hertz, and other investigators, x-rays were produced. However, they were not recognized as such until 1895 when Prof. Röntgen startled the world by the announcement of his discovery.

Fig. 4.--Heinrich Hertz.

Upon the memorable day of his discovery, Prof Röntgen was duplicating one of Lenard's experiments in the laboratory of the Würzberg University. The experiment consisted of passing an electric current through a Crookes tube covered with black cardboard, to test its florescence upon a piece of cardboard coated with barium platino-cyanide. A fresh specimen of this chemical had been prepared and spread upon the cardboard which was placed against the wall on the opposite side of the room to dry. The room was darkened and the current was passing through the tube, when to his amazement, Prof. Röntgen noticed that the chemically covered cardboard on the other side of the room was glowing with a wierd florescence. He approached the cardboard and in doing so passed between it and the Crookes tube, and beheld his shadow upon the card-

board. Picking up a book, he held it in front of the screen and noticed that it also cast a shadow. He then discovered that the luminous glow or florescence on the cardboard appeared and disappeared with the turning on and off of the current. With the tube operating, he picked up the cardboard and while examining it, noticed the shadow of his hand on its surface, the bones appearing much darker than the soft parts of the hand. He also found that the florescence was produced in the cardboard regardless of whether the chemically coated side was turned toward or away from the Crookes tube, showing that the rays had the power to penetrate substances at a distance from the tube.

Further investigation proved that the radiation producing these phenomena emanated from *the point of impact of the cathode rays* against the glass wall of the Crookes tube, that nearly all substances were transparent to it, although in widely different degrees, varying roughly with their density; that the radiation was rectilinear, that it could not be refracted, reflected, or deflected by a magnet. Hence it was plain to Röntgen that these rays were quite different from the cathode rays of Crookes, Hertz or Lenard.

Using photographic plates wrapped in black paper to protect them from ordinary light, he obtained with these new rays shadow pictures of metallic objects in a wooden box, and of the bones of the hand.

He continued his experiments both with the florescent screen and the photographic plate, and in December, 1895, communicated his discovery to the Physico-Medical Society of Würzburg. Being unable to determine the exact nature of this new ray other than classing the phenomenon as longitudinal vibrations of ether, Röntgen called it the x-ray, the letter x representing the unknown in the mathematical formula. Even today the exact nature of the rays has not been determined, although the concensus of opinion seems to be that they are violent ether pulses set up by the sudden stoppage of the cathode rays as they strike upon the walls of the tube or upon any intervening obstruction. If this theory be correct, x-rays are of the same general nature as light waves, but of such short wave length that they lie outside the visible spectrum.

Evidence—X-ray Pictures

X-RAY radiograph or shadow pictures are held admissible in evidence in the West Virginia case of Griffith v. American Coal Co. 84 S. E. 621, L.R.A. 1915F, 803, when shown to have been made with trustworthy instruments, and properly taken, in connection with the evidence of witnesses expert in the use of such instruments and skilled in making, reading and interpreting such pictures.—*The Medico-Legal Journal.*

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EDITORIALS

Orthodontia and Post-Graduate Instruction

THERE has never been a time in the history of the dental profession when so much attention was being given to post-graduate dental work as at present. The reason for this is that the profession has suddenly awakened to its responsibility and the dentists are trying to qualify themselves to meet that responsibility.

The medical profession has long recognized the value of post-graduate work, but it is only recently that the dental profession has considered that kind of instruction advisable. As a result a great many post-graduate courses are being offered on various subjects by different persons throughout the United States. We find that in some localities the dental profession is responding to post-graduate work with such enthusiasm that post-graduate clubs and post-graduate societies are being organized, the membership in some of these organizations being limited to men who have done post-graduate work.

The question of post-graduate instruction in the dental profession is at the present time somewhat of a problem, and courses are only in a developmental state. Among the first endeavors which we noticed of a post-graduate nature were the study clubs, which it is our impression were organized first in Iowa by men who took up certain lines of work under the tutelage of prominent men in the profession. The activities of these study clubs in Iowa had a very marked effect, for it seems that the dental profession in Iowa displayed greater interest in this subject than is manifested anywhere else by dentists in the United States. The plan adopted by these clubs could be followed advantageously by dentists in other parts of the country.

Another post-graduate effort was inaugurated by the Dental Society of Oklahoma, which for the past four years has followed the plan of conducting its state meetings along post-graduate lines. This has given rise to what is known as the "Oklahoma plan" and several other states have conducted meetings in a similar manner. Briefly, this plan is to have one or more men of national reputation deliver a series of lectures before the state society, whose meetings continue a week, and allowing the lecturers compensation for their work. The society members in addition to their regular state dues, are requested to pay a post-graduate fee, which covers the cost of post-graduate instruction. This plan has been remarkably successful, and the large proportion of dentists who attend the meeting in Oklahoma, which state has a comparatively small number of dentists, indicates that the profession is very much interested in the post-graduate idea. The Oklahoma plan was carried out on a larger scale at the Tristate Dental Meeting, which was held recently in Kansas City, made up of the societies of Kansas, Oklahoma, and Missouri, at which there were registered over fourteen hundred dentists, all of whom paid a special post-graduate fee in addition to their state dues for the special instruction.

We mention these two plans as methods by which post-graduate work can be given to the dental profession at a sum which will be comparatively small to the individual.

A third plan that has been followed by some instructors, is for the instructor to go to a town and organize a class for certain work for a stipulated sum. While there has been some objection to this plan for the reason that there may be a tendency on the part of some men to commercialize post-graduate instruction, we believe, however, that every man who has taken any of these post-graduate courses, regardless of the subject, feels that he has received greater value than can be estimated by the financial cost. If, therefore, the men who take such a course are satisfied that they have received what they paid for, we cannot imagine any good reason why anyone else should question the motive of the instructor in giving the course. While this may not be the most successful plan, which has been termed "barn storming" by those who are opposed to this method of post-graduate instruction, it has nevertheless accomplished a great amount of good, and we are inclined to believe such courses are not without benefit. It is not, however, our opinion that they are the ultimate solution of post-graduate instruction, or that they are the best plan of giving a course. We realize that some subjects in dentistry can be taught possibly in a few lectures—say, in a week by a class organized to take work in a certain locality—but there are other

subjects that require more elaborate preparation and more paraphernalia for teaching, and which cannot be successfully presented in such short time.

The fourth plan of post-graduate instruction has been the organization of post-graduate schools, which have been conducted in some localities for a number of years. These post-graduate schools, while they have probably been of considerable benefit to those who attended, have also had their objects misinterpreted by many persons, who are of the opinion that post-graduate schools are organized entirely for financial purposes and are money-makers for the men who are conducting them, and this opinion is emphasized by the fact that a large number of post-graduate schools have been established within the last few months for apparently no other object than to make money for the men who conducted these schools.

Among the first post-graduate schools was the Haskell School of Prosthetic Dentistry, which was organized by Dr. Haskell in Chicago a number of years ago and gave valuable instruction, but was not a financial success. Dr. Peeso organized the Peeso School for Crown and Bridge Work, which later affiliated with the University of Pennsylvania. This school also rendered good service, and was probably one of the greatest factors for the standardization of removable bridge work and for the perfection of bridge technic. In orthodontic post-graduate instruction the Angle School of Orthodontia was the first school to be organized, and probably as the result of its organization, the practice of orthodontia was advanced more than by any other effort. Some individuals criticised the Angle School and its methods, but the fact is that the majority of the graduates of that school were extremely successful; in fact, they were so successful that it became a desideratum among the dental profession to be known as an Angle graduate. That such distinction was coveted is proved by the action of a number of men in different parts of the country who posed as "Angle graduates" who had never been instructed in that school. This post-graduate instruction, like others that we have mentioned, was not a financial success. After being conducted a number of years, the school was discontinued, which suggested the necessity of some measures being provided by which, in the future, instruction of the character given in the Angle School could be acquired.

One of the objections to post-graduate courses in orthodontia was that they were limited to eight weeks, which some of the profession considered as too short a time. While we will admit that eight weeks is not sufficient in which to learn orthodontia, it must be borne in mind that we must deal with a condition, and not with an ideal. The orthodontic students in the past have been men of the dental profession who were depending upon their calling for a livelihood, and who were limited as to the amount of time they could devote to post-graduate work. In other words, the man who has an established practice, and who depends on that practice for a livelihood, cannot devote eight or nine months to a post-graduate course, as the financial sacrifice would be too great. In fact, most of the prospective students object even to an eight weeks' course, but they are not aware of the amount or character of work which must be covered in that time and they also object to the loss incurred by leaving their office for eight weeks. Experience has, however, shown that eight weeks is a logical compro-

mise. A longer time would be much better, but with the majority of students it would be impossible to attend for a longer period.

One of the problems which confronts the dental profession at the present time is that there is no standard for post-graduate instruction. Anyone who so desires can open a post-graduate dental school or give a post-graduate course, and there is no way to determine what the quality of the instructions may be. It is true, the American Society of Orthodontists at its meeting in Toronto had an education committee appointed by the president, Dr. Kemple, and the object of that committee is to inquire into the value of the contemplated post-graduate instruction, and to endeavor to standardize orthodontic instruction in dental schools. This committee has no legislative authority, and will be limited to making recommendations, which we hope it will do. If, however, recommendations are made that may be construed as a criticism of certain post-graduate schools, the members of the committee would lay themselves liable to possible damage suits, as the American Society of Orthodontists is not incorporated. It is to be hoped, however, that this committee will do something toward bringing order out of chaos, and that its effort will have a tendency to standardize post-graduate instruction.

Orthodontia and Process Patents

THE dental profession is quite familiar with process patents and the attitude which the majority of the members of the profession maintains in regard to those patents. Many members are cognizant of the trouble which some of the older practitioners had several years ago with a certain crown and tooth company and a certain rubber company over process patents, and are also aware of the controversy at the present time in regard to other process patents, but the relation of orthodontia to these patents has been greatly misunderstood by a large proportion of orthodontists. Up to the present time orthodontists have been free from annoyance regarding process patents, but we have no guarantee that they will continue to enjoy that freedom if the use of these patents becomes the rule in the dental profession. In other words, if the legality of certain process patents were to be established, there is no doubt in our mind that we would be affected by some of these patents covering certain phases of orthodontia.

Some practitioners claim there is no difference between process patents and device patents, but those who make that claim do so because they are in favor of process patents, or because they have failed to investigate the difference between the two kinds of patents. The patent attorneys recognize what are known as device patents and process patents. A device patent is one which protects the manufacturer of a certain article, which article can be placed on sale, and its use is unrestricted. The patent prohibits the manufacture and sale of that device by another manufacturer. A process patent is one which also may cover a device, but, in addition, contains a clause which prohibits the use of that device except in a manner described by the manufacturer. There is no question about the legality of either kind of these patents if, in case of doubt, such legality can be established in court. The dental and medical professions have not, however, been in favor of process patents, and the medical profession has been specially

opposed to device patents which cover any appliance used in healing or in relieving human suffering. The dental profession has never been opposed to device patents and we are now confronted with the proposition of paying enormous royalties to manufacturers who hold patents on certain instruments, which could be made and sold for about one-fourth of their present price if they were not protected by patents.

There are at present a large number of orthodontic appliances on the market that are covered by device patents. It may be admitted that one who, by his ingenuity, devises a certain practical appliance should be entitled to some kind of protection during a number of years, and that is the generally accepted opinion. Of the various orthodontic patents with which we are familiar we will refer to one that is a process patent. This patent covers the application of the alignment wire, and if process patents are established in the dental profession, the holders of this patent could prohibit the use of alignment wires unless they were made by their company. Also, if the legality of process patents should be established, a patent might be secured for taking a plaster impression or making a model, as one could not determine where the unscrupulous manufacturer or designer would stop in his efforts to obtain process patents.

There is also a patent that covers the gingival extension of the appliance for gripping below the convex portion of the tooth, which patent could be made applicable to almost any form of band or clamp that may be used in the practice of orthodontia.

For these reasons we believe that, as a matter of protection and principle, orthodontists should realize the possibility of the creation of a pernicious condition with which they may be confronted, and take steps to protect themselves by supporting legitimate organizations whose object is to investigate any patented article or process that may be obnoxious to the profession, and to especially guard against process patents.

The St. Louis Dental Society

ST. LOUIS enjoys the distinction of having one of the oldest dental societies in the world which is still in a very flourishing and prosperous condition, probably more so than at any time during its entire history.

In commemoration of this distinction, it will on November 16, 17 and 18 celebrate the sixtieth anniversary of its organization by the largest and most complete meeting ever held in the St. Louis district.

Sixty years in dentistry have witnessed many changes throughout the world, but during the vicissitudes of half a century this society has pursued the even tenor of its ways. If its original organizers were now permitted to look down upon the vista of years they would behold many changes. They would witness the struggle between the states in their own land, the rise of a small province in Germany with von Moltke and Bismarck as the guiding stars, deposing Napoleon III as the war lord of Europe. In science, then, contrast would be even more outstanding. From a one-year course in dentistry with no statehood to examine as to an applicant's qualifications as a dental practitioner, they would be

confronted with the present high entrance requirements, a four-year course, and a state board of dental examiners extending every effort not only to maintain a high standard but to constantly elevate the standard. Problems in dentistry that baffled all their efforts to master they would now see solved; diseases and conditions that thwarted all their efforts to overcome they would see yielding readily to treatment under modern therapeutic measures.

The St. Louis Dental Society has developed some of the brightest stars in dentistry, among whom might be mentioned H. J. B. McKellops who introduced the use of the mallet in dentistry before the Odontological Society of London in the year 1864. At the time of his death, April 23, 1901, he possessed the most complete and valuable dental library in the world. Other pioneers were Bowman, who is still in active practice, and Black.

In commendation of the work of the pioneers of this society its present members are planning to celebrate its 60th anniversary in a manner commensurate with its importance and historic interest. Papers will be read by some of the most prominent and able men in the dental profession. Many of the clinics will be of the popular club clinic idea and the modern idea will be carried out throughout the clinic plan.

Too much cannot be said in support of the progressive spirit shown by the dentists of St. Louis and the St. Louis Dental Society in launching what promises to be one of the largest and most interesting dental meetings ever held in the middle west. Not only has this meeting been supported in good will entirely, but we are advised that the members of the dental profession of St. Louis have amply financed this meeting by their own subscriptions assisted by the various dental supply houses. If there has been "anything wrong with dentistry in St. Louis" in the past, we are unable to see any present indications of such being true and feel that St. Louis is to be congratulated upon the tremendous efforts being made for their anniversary meeting.

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ORIGINAL ARTICLES

FACE FACTS

(Continued from page 197.)

BY B. E. LISCHER, D.M.D., ST. LOUIS.
Professor of Orthodontics, Washington University Dental School.

FOLLOWING our brief outline of the anomalies of dentition (which should form the basis of any rational diagnostic scheme), it may not be amiss to give a short review of some of the theories advocated for critical study of the facial deformities which complicate malocclusions.

A knowledge of their pathology is admittedly of fundamental importance; it reveals the *internal structure* of these malformations. But since they include the most conspicuous external area of the body, we are compelled to consider, if only briefly, that most remarkable and characteristic problem of esthetics, namely, *beauty of form.*

In his study on *"The Nature of Beauty"* Professor Santayana has very aptly said that *"The philosophy of beauty is a theory of values."* Continuing he says:

"It would be easy to find a definition of beauty that should give in a few words a telling paraphrase of the word. We know on excellent authority that beauty is truth, that it is the expression of the ideal, the symbol of divine perfection, and the sensible manifestation of the good. A litany of these titles of honor might easily be compiled, and repeated in praise of our divinity. Such phrases stimulate thought and give us a momentary pleasure, but they hardly bring any permanent enlightenment. A definition that should really define must be nothing less than the exposition of the origin, place and elements of beauty as an object of human experience. We must learn from it as far as possible, why, when, and how beauty appears, what conditions an object must fulfill to be beautiful, what elements of our nature make us sensible of beauty, and what the relation is between the constitution of the object and the excitement of our sensibility. Nothing less will make us understand what esthetic appreciation is."

It is obvious that we are thus involved in a very difficult subject, which probably explains the lack of unanimity among our leaders; and we need not be surprised, therefore, to find several schools of thought promulgating conflicting rules for our guidance in practice. "Long before we can attain the ideal unification of experience under one theory, the various fields of thought demand provisional surveys." Hence it may be no misfortune to maintain that *"a rational harmony*

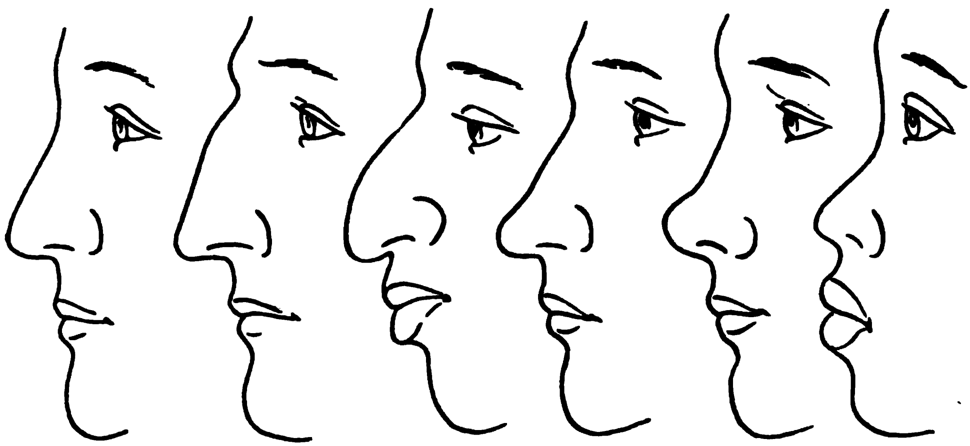


Fig. 26.—Nasal variations affecting the profile.

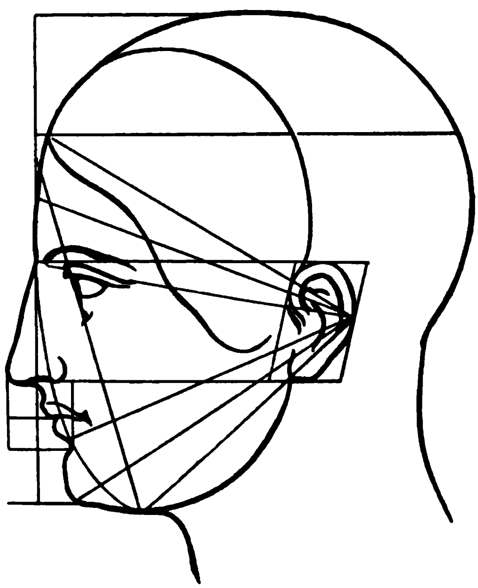


Fig. 27.—Wiegall's method for determining profile proportions.

exists between beauty and utility" (however difficult it may be to establish such a theory as a philosophic principle), because our experience certainly teaches us *"the dangers of indeterminateness."* Besides, it is so wholly human to cling to seeming bounds.

VI. ORTHODONTIC CONCEPTIONS AND IDEALS.

Esthetics has been defined as the science of the beautiful. In attempting to represent different phases of mental conception, students of the fine arts have formulated numerous methods for determining the proportions of the human form. The lines of division shown in Fig. 27 show a method suggested by Wiegall.

Raymond is of the opinion that "probably half the people in the world, without ever having been aware of it, have been in the habit of perceiving" human faces in some such manner. "In other words, they have been in the habit, when looking at a face, of comparing, mentally, the distance between the chief line of the eyebrows and of the eye, with the distance between the nostrils and the mouth, and also of comparing, above and below these narrower spaces, the wider distances between the hair and the eyebrows, the eyes and the nostrils, and the mouth and chin" (Fig. 28).

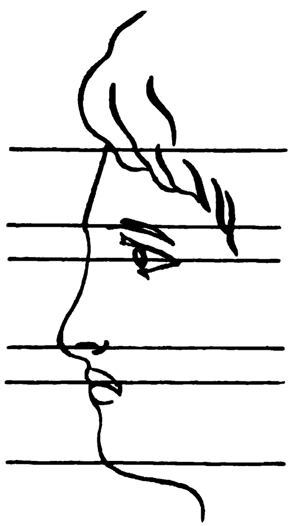


Fig. 28.—Raymond's method.

Fig. 29.—Farrar's method.

The mere fact that orthodontics embraces remedial measures with which facial deformities may be corrected, predicates the need for a criterion, or rule, for our guidance. "The duties of an orthodontist force upon him great responsibilities, and there is nothing in which the student of orthodontia should be more keenly interested nor better informed than in the study of the artistic proportions and relations of the features of the human face; for each of his efforts, whether he realizes it or not, makes for beauty or ugliness, for harmony or inharmony, for perfection or deformity" (Angle). Ignorance of these facts has frequently been the cause of failures which might easily have been avoided. To permanently mar a human face is an accomplishment which few covet.

In the works of Kinsley, Farrar, etc., we perceive that the need for a rule as an aid in diagnosis was plainly felt. Farrar adopted the classical profile of Apollo as a cover-design for his work on "Irregularities of the Teeth" (Fig.

29). It will be noticed that he drew a perpendicular line across this profile which touched the frontal eminence and bisected the ala of the nose. The mentum, or chin, did not quite come into contact with this line.

In Chapter II of the so-called "Sixth Edition" of Angle's "Malocclusion of the Teeth," we again note this profile drawing, though slightly altered (Fig. 30). In the description of this drawing Angle said: "In studying the perfection of the profile it will be seen that it is in perfect harmony with a straight line at three points,—namely, the most prominent points of the frontal and mental eminences and the middle of the ala of the nose. As a convenience we shall call this the *line of harmony. It will be found of great value as a basis*

Fig. 30.—Method formerly employed by Angle.

*of diagnosis,** serving the same purpose in the esthetics of the face as does the line of occlusion in indicating the variations of the teeth from the normal alignment."

In a subsequent edition of his work, Angle freely admits the fallacy of the above, for he says:

"We know while all human faces are greatly alike, yet that all differ. Lines and rules for their measurement have ever been sought by artists, and may have been the plans for determining some basic line or principle from which to detect variations from the normal, *but no line, or measurement, admits of anything nearly like universal application."**

"The beautiful face of the Apollo Belvidere has been very largely used as a guide toward the ideal and from which to judge variations, but this is impracticable and misleading, for, notwithstanding the beautiful harmony of proportions of that face, with its straight line touching the frontal and mental eminences and the middle of the wing of the nose,† its range of application has

*Italics are mine.
†In a paper read before the National Dental Association in 1901, the late Dr. Goddard disproved this.

been found to be very limited in gauging the harmony or inharmony of other faces."

"And this is not surprising when we realize that the Apollo face represents the ideal of the Greek type and the Greek type only, and that we today see not only very few faces of a purely Grecian type, but for that matter, very few of any pure type, unless it be an occasional Roman."

"In the early days artists dealt wholly with pure types, as is unmistakably shown in their works that have come down to us. In Grecian art, both painting and sculpture, the faces all conform to the Apollo type, and the type was constant because the blood of the people was pure, that is, comparatively free from admixture with races of different types."

He then quotes Professor E. H. Wuerpel, dean of the Washington University Art School, as follows:

"The ideal of the Roman type, though markedly different from the Grecian, was also closely followed by their painters and sculptors, and where types and religious ideals were so distinctive and so closely adhered to there could be certain standards and laws to govern them, especially in creative art; but to use the Grecian or the Roman standard as a gauge for the types for the present day, especially in America, is impracticable, for our inheritance, our occupations, our mental activities, our habits of thought, our social and climatic conditions, etc., etc., differ so radically, and all these play such a vital part in the molding of the mental, moral and physical, as expressed in our whole bodies and especially in our faces, that a standard type is an impossibility. The tendency of modern civilization seems to be to create a law for each individual, and in the face of complex and constantly changing conditions a fixed type as a basis or standard to govern the molding of the human face cannot be established."

Continuing, Angle says:

"This may all seem discouraging to the orthodontist, but there is a principle, which intelligently applied brings us the nearest to an ideal result possible with each given patient—that of balance, of symmetry. We should be able to detect not whether the lines of the face conform to some certain standard, but whether the features of each individual—that is, the forehead, the nose, the chin, the lips, etc.—balance, harmonize, or whether they are out of balance, out of harmony, and what concerns us most as orthodontists: whether the mouth is in harmonious relations with the other features, and if not, what is necessary to establish its proper balance."

"Now, the ability to determine the proper balance of the features is rare. One of our foremost teachers of art, Mr. E. H. Wuerpel, says that only one in two or three hundred of even art students ever succeed in mastering it, and these only after much observation and practice in sketching and modeling the human face. Yet discouraging even as this seems we believe there is a law for determining the best balance of the features, or at least the best balance of the mouth with the rest of the features, which artists probably know nothing of, and one which for our work is far more unvarying and more reliable than even the judgment of the favored few. It is, furthermore, a law so plain and so simple that all can understand and apply it. It is that the best balance, the

best harmony, the best proportions of the mouth in its relations to the other features require that there shall be *the full complement of teeth, and that each tooth shall be made to occupy its normal position—normal occlusion.*"

"The correctness of this rule will be better appreciated if we will but remember that in those cases where nature has succeeded in building a normal denture—teeth in normal occlusion—she has also succeeded in building it so as to be in best harmony with the lines of the face, or, conversely, the lines of the face to best harmonize with this denture, and that the teeth in these cases are noticeable marks of beauty. And as malocclusion is but the perversion of normal occlusion, it invariably will be noticed that inharmony in the balance of the mouth with the rest of the lines of the face exists just in proportion to the extent of the malocclusion."

"This law may be regarded as one of the corner-stones of the new school of orthodontia in contradistinction to the teaching that has always dominated the practice of the old school—that of leaving to the individual judgment of the operator, without any standard, the determination of the requirements in orthodontic operations in each given case."

"To satisfy this individual judgment extraction was often, and in complex cases always, resorted to. Its unfortunate and inartistic results may be seen in every community. It is gratifying to note, however, that this fallacious teaching and pernicious practice are rapidly passing and will doubtless soon become mere matters of history."

Expressed differently, Angle maintains that the outward form of the changeable area of the face is dependent upon the relative normality of the denture within; and that, as a rule, it is best to establish normal occlusion (which implies the presence of each tooth), and thus strike a balance which is rarely wrong. Theoretically, this is not absolutely true; and it can hardly be called a law, using the word in its scientific sense.

In other words, it is true because it ought to be true; and if we would limit our treatments to young children in the developmental period, the normal growth of malformed structures surrounding the teeth would probably always follow. The profile of a growing child must never be considered as a fixed line (at least not immediately after tooth movement has been accomplished), but one in which further changes will continue to take place.

I have already stated that we need not be surprised if we find various schools of thought promulgating conflicting rules for our guidance in practice. The above quotations from Angle contain the gist of his attitude on this subject, and, so far as the writer is aware, his latest teachings. But before passing to the views of a leader like Case, whose findings are in many respects diametrically opposed to Angle, I would like to call the reader's attention to the following significant statement, which appears on page 74 of Angle's last edition.

"The author would not be understood as intending to imply that every face with lines and features in harmony of balance must necessarily be beautiful, not even that placing maloccluded teeth in normal occlusion will establish harmony of balance of every face in its entirety. There may be other defects such as the lack of development of the nose or chin, or unequal development of the two malar bones, or of any of the bones of the face, etc. These defects of course

could not be remedied by the correction of malocclusion, but the best harmony of such faces or of any face is only possible when the teeth are in normal occlusion."

In other words, he, too, admits that *"there may be other defects such as lack of development of the chin, * * * or of any of the bones of the face,"* etc. And, *"These defects of course could not be remedied by the correction of malocclusion, etc."*

A large experience and much careful observation have led Professor Case to formulate the following principles:

"The portion of the human face that it is possible to change with dental regulating apparatus may be said to lie between diverging lines which arise at

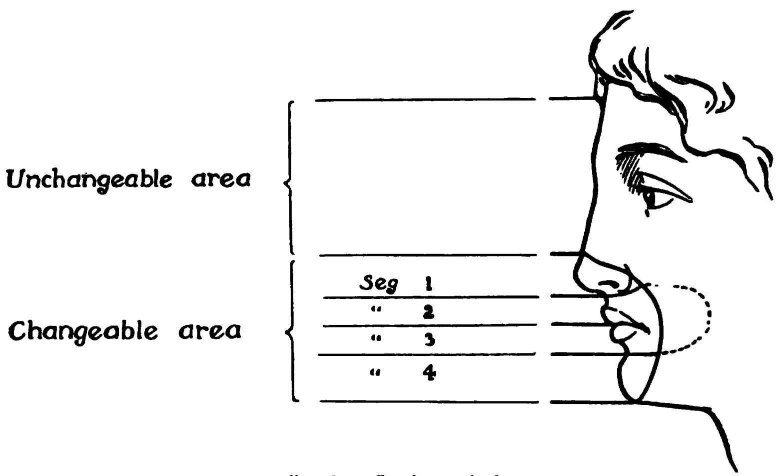


Fig. 31.—Case's method.

a point below the ridge of the nose and curve downward to enclose the alæ and depressions on either side; thence laterally to encircle a portion of the cheek, and downward to enclose the entire chin (Fig. 31). This area may be termed the *changeable area* in contradistinction to the more stable features, or *unchangeable area.* For convenience of ready reference, the features in that portion of the changeable area which are bounded laterally by the nasolabial lines may be divided into segments, as follows:

"Segment 1. The end of the nose and the upper portion of the upper lip, including the nasolabial depressions.

"Segment 2. The lower portion of the upper lip.

"Segment 3. The lower lip.

"Segment 4. The chin.

"These four segments are changeable in their relations to each other, and also in their individual relation to features in the unchangeable area."

Dr. Case further maintains that the relations of these areas to each other must be determined prior to treatment by *the trained eye of the operator,* and the deviations, if any, noted. Following this, the treatment must be planned so as to produce the best possible exterior effects or contour of these parts. In

other words, the operator's ideal of facial form is the standard, or criterion, he would have us accept. It is presumed, of course, that this be a cultivated ideal, carrying with it that fine discretionary ability to say when teeth shall be extracted, or moved bodily, for the improvement of facial balance. According to this author, the full complement of teeth is not necessary in the treatment of certain types of malocclusion; in some instances extraction of one or more teeth is positively indicated.

Theoretically, this is certainly true, because "Beauty of form cannot be reduced to beauty of elements. All marble houses are not equally beautiful." Similarly, all profiles, even though they are moulded over an ideal occlusion of all the permanent teeth, are not equally beautiful. "All ideal forms have an emotional tinge. Beauty of form is due to expression, and all expression, ultimately, is something else than beauty—some practical or moral good." For

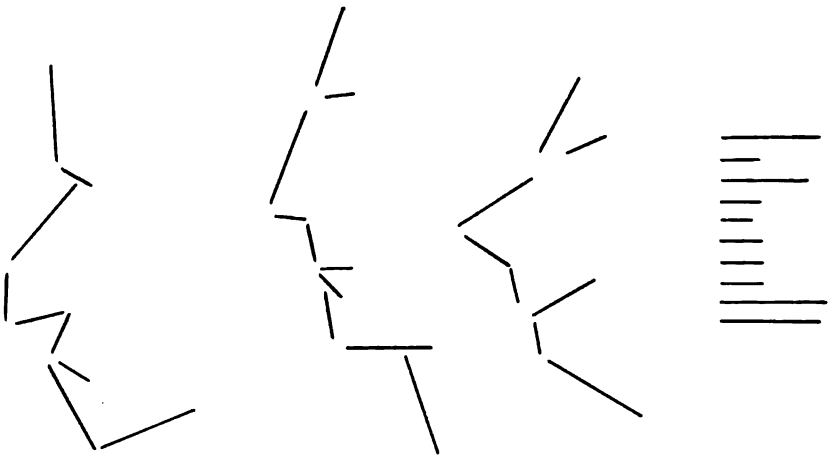


Fig. 32.—Shows the unrelatedness of beauty of form to elements. (Santayana.)

example, "take the ten meaningless short lines in Fig. 32 and arrange them in the given ways intended to represent the human face; there appear at once notable different esthetic values. Two of the forms are differently grotesque, and one approximately beautiful. These effects are due to the *expression* of the lines; not only because they make one think of fair or ugly faces, but because, it may be said, these faces would in reality be fair or ugly according to their expression, according to the vital and moral associations of the different types." (Santayana.)

VII. CLINICAL DIAGNOSTIC AIDS.

It must be obvious to the reader that, if possible, it would be desirable to ascertain in advance the probable effect of the treatment upon the patient's facial lines. Fortunately, in a limited number of types, we are able to estimate the result in a fairly accurate manner. For example, let us take a case of *neutroclusion* complicated by linguoversion of the upper and lower incisors (Fig. 33, a). Pieces of softened wax may be moulded over the occluded models and trimmed to a form approaching the future alinement of these teeth (Fig. 33, b). After the wax is washed in cold water it is placed in position on the

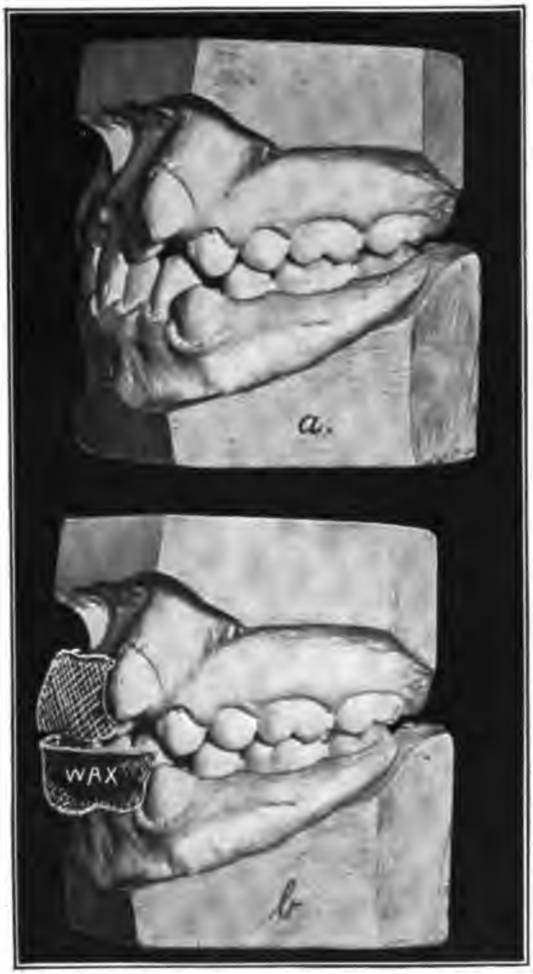


Fig. 33.—Shows the author's method for estimating in advance the probable effect of an orthodontic treatment; compare with Fig. 34. (From Lischer's Orthodontics, courtesy of Lea & Febiger.)

Fig. 34.—Photographs of the patient before and after the use of the wax model shown in Fig. 33,*b*.

Fig. 35.—Method employed in *distoclusions;* compare with Fig. 36, *a* and *b*. (Courtesy of Lea & Febiger.)

Fig. 36.—Photographs of patient shown in Fig. 35, *a* and *b;* note change in profile in *b*. (Courtesy of Lea & Febiger.)

Fig. 37.—Same method as in Fig. 35, *a* and *b*; compare with Fig. 38. (Courtesy of Lea & Febiger.)

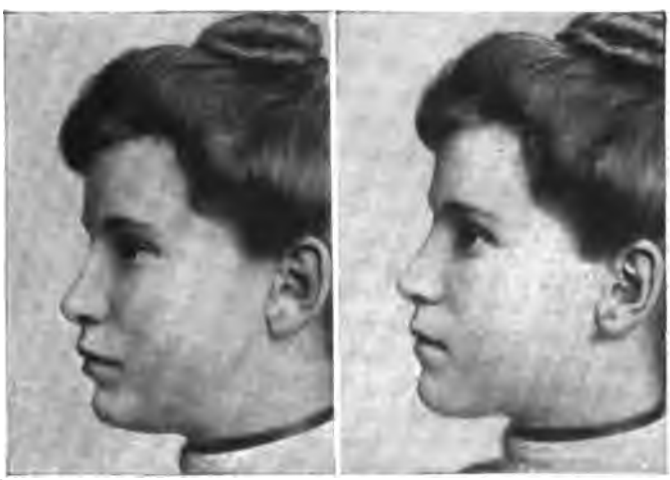


Fig. 38.—Photographs of case shown in Fig. 37. (Courtesy of Lea & Febiger.)

teeth. The patient is now asked to relax all tension of the lip muscles, which allows the facial lines to assume the form which the treatment will in all probability produce (Fig. 34, a and b). In cases where only the upper incisors are in linguoversion, the amount of wax employed is accordingly reduced.

In *distoclusion* complicated by labioversion of the upper incisors the patient may be asked to bite mesially so as to bring the first molars into a normal mesiodistal relationship (Fig. 35, a and b). Fig. 36 (a and b), shows photographs of the patient taken with the teeth in the positions shown in Fig. 35. In b, Fig. 36, the patient is shown to be conscious of the effort, a defect which a successful treatment would remove. But it at least demonstrates that if the lower arch is moved forward on its osseus base, a noticeable improvement in the lower lip and mentolabial sulcus will follow. It is also a good method for demonstrating to parents the fallacy of regarding the labioversion of the upper incisors as the primary pathological condition.

Similar preliminary studies can be made of patients presenting a distoclusion complicated by linguoversion of the upper central incisors (Fig. 37, a and b; Fig. 38, a and b). This type is frequently further complicated by infraversion of the molars and bicuspids, and supraversion of the incisors (Rogers), and occasionally results in mandibular micrognathia and mandibular retroversion (Federspiel), as we shall note in detail later. For studies of such cases, Dr. Case has suggested a temporary "opening of the bite" (*Dental Orthopedia,* p. 323). If necessary, generous pieces of modeling compound, or wax, may be inserted between the occlusal surfaces of the bicuspids and molars to prevent complete closure, and while in this position a study of the profile can be made.

Unfortunately, in mesioclusions, and in many of the more serious forms of dento-facial deformity, these methods are inapplicable.

(To be continued.)

MODERN OFFICE APPOINTMENT FOR THE ORTHODONTIST

By R. C. Willett, D.M.D., Peoria, Illinois.

SECTION II.

It is the purpose of this section to show the foundation, fact and reason upon which men of our profession should make plans for a well-kept, well-decorated and well-appointed office suite. This section will also contain certain definite suggestions regarding the practical planning and fitting out of office rooms, and will contain, as illustrations of the points which are recited, the floor plan and reproductions of interior photographs of an office suite which has been planned and put into effect. Personally the writer claims no authority as a psychologist, art critic, color expert, architect or furniture connoisseur. However, the statements which will be made on these and other subjects in this section are not without authority.

The offices of professional men are like the individual men who occupy them. Consciously or unconsciously we write our training, experience, knowledge and some of our habits into the appointment, the furnishings and the appearance of our offices.

Are we men of orderly habits? Then our offices will tell it. Are we seekers after personal glory and personal advertisement? Then this will manifest itself. Are we appreciative of art? Then there will be art in the arrangement and in the things found in our offices. Are we uncultured, narrow, selfish, bigoted, grasping or self-centered? Then these will express themselves in some manner. Are we really deeply interested in helping the children of this generation grow up into perfect specimens of manhood and womanhood—well balanced physically, mentally and morally? If we are, this interest will be reflected in no small degree in the offices which we occupy—the dumb walls, voiceless furniture, and the very magazines, pictures, paintings, books and general atmosphere will tell the people that the man who occupies the office is definitely interested in the welfare of the children.

These statements are not real fancies. They are in accord with the most accepted theories of psychology. "Houses are like the individuals who inhabit them," said Victor Hugo. "If you are a good man, and true, your castle will show it," said the great Aristotle in his "De Anima." "In whatever man does, on work or play, he expresses his ideals," says William T. Harris. "Do not try to hide your thoughts," said the great Hume, "for they speak loudest when your voice is still. The quarters which you build around you express your character and your thoughts perhaps better than could your meager words." "We write in large hand our likes and dislikes on the floors, walls and make-up of our houses, and we are to be measured accordingly," says Fred Hamilton Daniels.

This testimony of the psychologists is corroborated by our own experience. We admit that any imperfections which exist in our office appointments, correspond with a certain lack of knowledge in our individual make-up; and the

good things in our office appointment correspond with a certain developed knowledge which we possess.

From the foregoing statements it is true that a man without art among his qualities will not likely display the most correct or appropriate art in his home or office. It is also true that a man without a knowledge of color will not be an expert in preparing a color scheme for his office suite. (Let it be said here, however, that as regards color the orthodontist, being a man whose natural

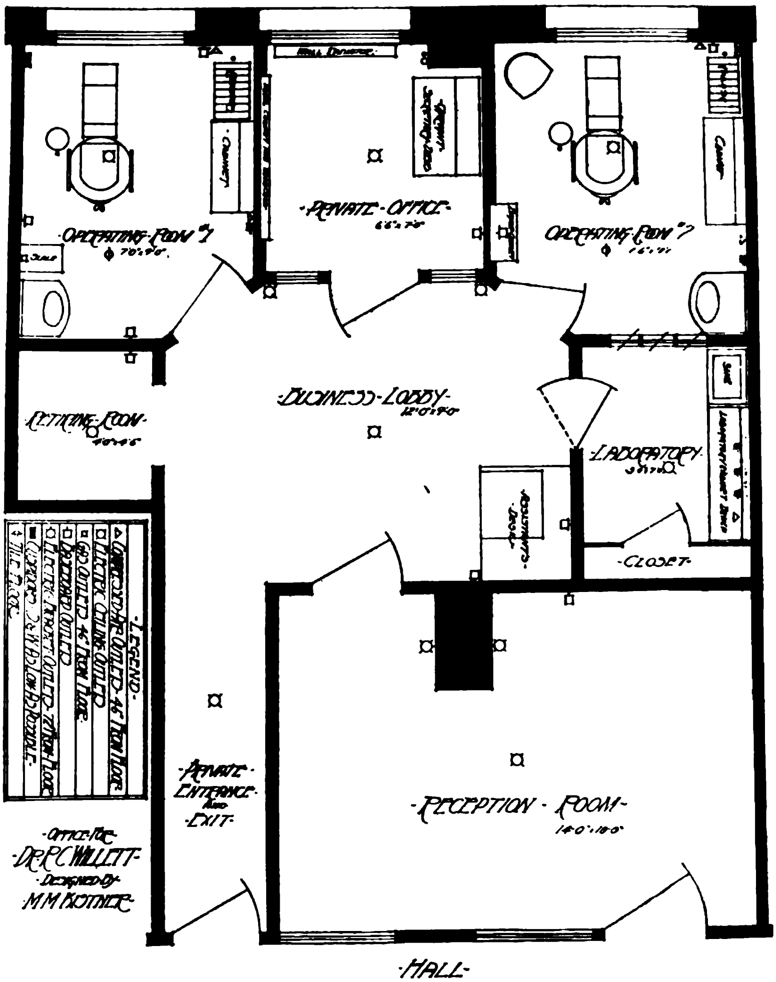


Fig. 1.—The floor plan of an office suite, the use of which is further illustrated in Figs. 2 to 13.

bent is along technical lines, should easily acquire the definite rules and laws which demonstrate to almost a mathematical accuracy the degree in which certain colors harmonize, even though he does not possess a natural sense of color.) A man without knowledge of furniture and its real meaning will probably not display the best of taste in his office furniture. A man with no appreciation of proportion, order or simplicity will scarcely be expected to exemplify these three things in the artful planning of his office appointment. An orthodontist

with no appreciation of children will hardly provide the best children's literature for the use of the young folks who come into his office as patients.

However, there is a solution for these situations. Not in securing a professional decorator to take all of this work off our hands and to equip our office —for that would be only a partial solution. The individual, by a comparatively small amount of study or direction, can acquire sufficient knowledge of these things so that he can intelligently and satisfactorily answer the problems himself. If he decides then to call in a professional decorator to assist him, then that is proper. But unless the individual has sufficient knowledge to express something of his own personality and individuality in his office improvements

Fig. 2.—Corner of reception room opposite main entrance from corridor.

a professional decorator can be of little valuable service. The only instance when a professional decorator could successfully handle the whole situation for a man who himself is not capable of expressing his own individuality in his office appointments is where this professional decorator is a psychologist who can read the professional man's mind and determine the environment in which this man would be best suited. But was there ever such a decorator?

Individuality and personality are absolutely essential to a well appointed office. Ruskin, who is as great an authority on art and social reform as the world has produced, has the following to say in his book, "The Two Paths:" "It is not only possible, but a frequent condition of human action, to DO right

and BE right—yet so as to mislead other people if they rashly imitate the thing done. For there are many rights which are not absolutely, but relatively right —right only for THAT person to do under those circumstances,—not for THIS person to do under other circumstances."

While it might appear that an exceptional natural knowledge of art and proportion might be necessary in order to be qualified to properly appoint an office—this is not the case. "A natural knowledge of any particular art is rare," said Platem, "but it is given to nearly everyone to cultivate a taste for this art." Each art is bound up in various puzzling rules and laws which ap-

Fig. 3.—End of reception room leading to the business lobby.

pear like barbed wire fence to keep out intruders. But the barricades are in reality only trifles.

Professional men who have attempted modern office furnishing often make the mistake of giving themselves over entirely to the professional equipment salesman. Are we going to make our office appointment carry the appearance of purchased refinement? If we do, then there will be a lack of harmony between ourselves and our surroundings. While these conditions may not be analyzed by the people who visit our office suite, there will be an indescribable void in our office—that genuineness would be missing which would otherwise be in evidence if our own personality had entered into the plans and appointments.

Although our offices should be expressive of ourselves, there is possible the mistake of making our offices appear to over-advertise the man who occupies them. This is perhaps as great an error as that of leaving out our individuality and personality in the appointing of our rooms. Few things in office equipping are more revolting to an esthetic mind than those which continuously seem to force thoughts of the individual professional man upon the people who come to the office for treatment or counsel. In such offices the pictures and other decorative features appear to be always shouting the praises of the owner.

The real objects of having well appointed, nice appearing and well kept

Fig. 4.—Corner of business lobby showing the assistant's desk and view of reception room as shown in Fig. 3.

offices should be constantly in mind when we are preparing our rooms. Offices should be made comfortable, attractive and pleasing, not for any financial benefit which might follow. This is something which should be positively guarded against. Just as soon as professional men as a group or as individuals begin to evolve artistic planning of their offices into means for "money sucking" and exploiting the public, just so soon will the true purpose of our professional life be lost. Our offices should be well appointed for the plain purpose of making life more livable and real through the practical use of material things insofar as these will apply to life. Well appointed offices will do a double service—make our own individual lives brighter and more serviceable, and a benefit to the people who come to our offices.

The office plan shown in Fig. 1 is one which has been put into effect by the writer. It is cited here not as a model but as an example upon which to base future remarks so that there will be common ground for discussion.

The space occupied by this office is one to be found in any office building. There are no special natural light advantages. The office is not on a corner, gaining light only from one side except for the small amount which is gained from the corridor in the building. It is not over large or small and the rental is such as should easily be afforded by an orthodontist of five years' practice.

The office is divided into the following rooms: Reception, business lobby,

Fig. 5.—Private office showing desk on the right side and model library case (closed) on the left.

two operating rooms, private office, laboratory, retiring room, and private exit. Each of these rooms is considered absolutely necessary to a well planned office.

The proportionate space occupied by the several rooms appears to be generally satisfactory. The utilization of every foot of space has also been worked out and the rooms are so arranged that few unnecessary steps are required in getting from one room to another. For example, the private office is shortened, without making it too small, so as to allow a straight line between the doors of the two operating rooms. There is also a direct route between both operating rooms and the laboratory.

The convenience of operating room No. 2 to the laboratory is that impression material may be prepared by the assistant and passed through the

swinging panel windows. Likewise, impressions and other things passed back to the laboratory.

The laboratory is lighted by artificial light when necessary and the windows let in direct air and direct light from the operating room. Other features of the office plans will be mentioned in the following brief description of the various rooms—taken in the order that they would be utilized in practice.

The reception room is a place where people may be at ease until they are wanted elsewhere. The essential requisites of this room are comfortable seating places. These seating places should be substantial—not only for their ap-

Fig. 6.—A view of two operating rooms and private office.

pearance but for the fact that children occupy them. While a child, like the adult, might admire the beauty of a delicate piece of bric-a-brac furniture, he will feel more at ease in the use of that which is comfortable and at the same time indestructible. Removable seats in chairs are out of place in an office. There is no necessity or reason for having a center or side table in the reception room. Such a table has no reason for existence in a reception room except that custom generally places it there. A table is generally misused by being a place to cover with wraps, books, magazines, or parcels which may have been brought in. For this reason it should be left out of the office scheme.

Of secondary importance in the reception room is that which contributes to both physical and mental ease—literature and decorations. Weekly maga-

zines of a sensational nature should be avoided. Substantial and readable children's magazines should be in evidence—bound with a patent magazine cover-binder makes them unusually serviceable and keeps them readable for a long period. Magazines and books pertaining to birds are particularly attractive to young people. These magazines and books, be it remembered, are kept in a rack of some kind, easily accessible.

The importance of good pictures and other art work for the reception room cannot be over-emphasized. Good pictures give an opportunity of looking out beyond the confines of the four walls. They never wear out. With each

Fig. 7.—View of doors shown in Fig. 6 closed. These form one side of the business lobby.

succeeding glance the good picture or painting grows in power—giving new ideas, new lessons and new thoughts. A poor picture is worth less than nothing. "Nothing grows older in an office quicker than a poor picture," says Frank A. Parsons. They can be read at a single glance. The educational value of good pictures is only now beginning to be fully realized.

In this connection the writer would make a side remark that the professional man would be of much more service to humanity—and at no financial sacrifice to himself—if he would buy more works of real art and merit and fewer of the things of personal adornment for himself or for idle indulgence that is soon forgotten. A diamond worn in a scarf pin or in a shirt stud may give the wearer some satisfaction, but nobody else benefits from it. A picture, on the

other hand, is just as staple a commodity (provided discretion is used in its selection and purchase) and it pleases not only the buyer but practically all the people who come in contact with it. Why not invest, now and then, in a real example of modern fine arts? Viewing it as an investment, if properly made through reputable dealers, the value is there as certain as it would be if invested in diamonds, the possession of which and the wearing of which more often denotes ostentation. The possession of real art never does this, as the mind of the person who is attracted and inspired by it does not ordinarily connect the owner with it.

Fig. 8.—Corner of operating room No. 1.

One of the faults of most professional decorators is that they do not leave a place for pictures, when pictures are really so essential to the restful appearance and real usefulness of a room. One lone good picture and no wall decorations is much to be preferred than the best of wall decorations and no picture.

Photographs of illustrious and near-illustrious friends are altogether out of place in a reception room or business lobby. A picture of some universal benefactor, however, is always in taste. If there is room for it, at least one national patriot's picture should be in the office. If there is any local artist of standing it is both considerate and proper to secure one of his works of art for the decoration of the office.

The business lobby (a corner of which is shown in Fig. 4) connects the re-

ception room with the working section of the office suite. It should be both comfortable and have a business like appearance. Necessarily it must be near the center of the office suite. The business lobby in the center of the suite eliminates an objectionable feature so often found—that is, operating rooms opening off the reception room. Such an arrangement could be based upon no better taste than placing a bath room where it would open out of a drawing room. The lobby is the natural place for the assistant's desk. From the reception room all professional equipment should be positively hidden. There is no reason for the flaunting of face masks, plaster molds, instruments, or other

Fig. 9.—View of operating room No. 2.

professional equipment in this or any other room. The use of wall pictures should be continued as in the reception room. This room is not intended as a place in which any of the patients will remain for any length of time—in fact, it is merely a room for joining the several other rooms and thus affording an efficient office system. Comfortable, roomy seating places, such as were in the reception room, are not needed. Plain, strong chairs will suffice—and few of them. As in the reception room there is no table—except that of the assistant.

There is no better place in which to mention the assistant's dress than in this connection. Unless your assistant is a trained nurse and in your practice you require her services as such, do not dress her like a trained nurse. This imitative garb of the trained nurse is in some localities being played equally as

strong as the terms "antiseptic" and "sterilization," where the quality exists in name only. Let the assistant be dressed in accordance with the duties she may be called upon to perform.

The private office (shown in Figs. 5 and 6) is the place where the professional man transacts his private business, files his models, professional data, correspondence, books, professional magazines, and where he writes or dictates his correspondence. A business desk, files for keeping his correspondence

Fig. 10.—Engine cabinet in operating room No. 2 (closed).

and other literature, sectional bookcases for his books, an enclosed cabinet for his molds and masks, and two chairs are the only furniture and equipment needed for this room. One of the chairs should be heavy and of a less easily moved type—for the use of the person who might be called into this private office to discuss some professional matter. The other chair should be light in weight—capable of being moved to suit the convenience of the owner. The necessity of keeping the molds and masks out of sight when not wanted is im-

perative. The closed cabinet on the left in Fig. 5 shows the manner in which the unsightliness of an open model case may be avoided.

The operating rooms (Figs. 8 and 9) should be sanitary, light, roomy, airy, simple in appearance. The operating chair and other professional equipment should be that which is planned and constructed for the use of orthodontists—and not something which has been adapted from some other profession. When possible, every piece of professional equipment should be so arranged that it can be under cover and out of sight when not in actual use. An illustration of such equipment concealment is given in the engine cabinet (Figs. 10 and 11). In one of the two operating rooms should be an ordinary chair, aside from the operating chair, this being for the use of a companion who might accompany the child during the first few visits which the child makes to the office.

Fig. 11.—Engine cabinet shown in Fig. 10 (open).

The laboratory (Fig. 12) should be close to both the business lobby and the operating rooms. Good lighting and ventilating are important, and caution

should be exercised in leaving no places where refuse might accumulate or which would tempt the owner to fill with anything which is not in actual use. Of all places where order and system is exercised, the laboratory should be the first.

The x-ray equipment may appear noticeably absent to some. Such apparatus has become entirely too common to the public to overwhelm them in your modernizing and progressiveness whether or not it is in evidence. The access that most of us in office buildings have to well equipped x-ray laboratories makes this investment unnecessary. There is no more economy or neces-

Fig. 12.—View of laboratory showing wall model cabinet, door opening into storage closet, work bench, and porcelain enamel plaster cans.

sity of operating and maintaining an x-ray equipment than there would be in owning a complete photographer's outfit and in doing the work ourselves which we usually send to a photographer.

The retiring room (corner of which is shown in Fig. 13) should open off the business lobby. A hall tree, rack, mirror, roomy umbrella rack, and chair are the only necessary furniture. This is the only place in the entire suite of rooms where wraps may be left. There are no other hooks, and not even a table where clothes might be left lying. As may be seen from the floor plan (Fig. 1), the retiring room is close to the private exit so as to make additional steps unnecessary.

The private exit (Fig. 13) is a necessity. By utilizing this exit patients

who are leaving will not bother those waiting in the reception room. The doctor or assistants will have no reason to go through the reception room.

The value of a well selected and a well executed color scheme for an office cannot be overestimated. Three of the common and possibly the most primitive means of man expressing his thoughts are in language, music and color. Color is one of the most potent and certainly one of the most pleasing means of expressing thought. Also it is the most abused and least understood.

For practical purposes the floor covering is perhaps the first thing to consider in planning a color scheme. This would not be the case if carpets

Fig. 13.—Hall leading to private entrance and patients' exit. One corner of retiring room is shown where hooks are placed at a convenient height for children's use.

or rugs of a certain desired texture and color could be secured readily. The floor is covered for comfort and to make it more beautiful by softening the wood appearance and adding texture. Oriental rugs, being designed primarily as prayer rugs, or rugs to be sat upon, are not particularly suited for real service on a floor. They should be taboo in planning an office. The dominating tone of the floor covering should be the dominating tone in the wall. The floor covering should be modest in color and appearance, eliminating the disposition of a person to "place his feet with conscious calculation."

The psychological meaning of colors is of vital necessity if we would make the most of this important feature of decorating.

According to the scientists the three elemental pigments are yellow, red

and blue. All other color tones may be made from these three colors. Consequently, these three colors are the most easily grasped. Normal green is one-half yellow and one-half blue; orange is one-half yellow and one-half red; purple is one-half blue and one-half red. These latter three colors are the binary colors.

Yellow resembles the sun or some form of artificial light, like light it therefore brings cheer into a room. It is buoyant and cheerful.

Red represents blood or fire—it arouses passions and creates ideas of irritation and warmth.

Blue is non-aggressive. It has a tendency to hold red in check or destroys the too-pronounced effect of red and yellow in a group where the three appear. Blue represents coldness—like the blue sky in winter. It means formality, coolness, repose and restraint.

Green, which is yellow and blue, has the characteristics of these two colors. It is cheerful and cool; it has light and restraint. It renders people comfortable. Scientists claim that it is the most restful color to the eyes.

Orange, which is red and yellow, has the characteristics of both of these colors. It is heat and light; passionate and buoyant. It is practically opposed to green.

Purple, which is blue and red, possesses the characteristics of both of these two colors. It is cool and hot; reposeful and passionate. It practically destroys itself as far as color significance is concerned. Consequently it interprets mysticism, sorrow and dignity.

These six colors represent certain distinct sensations or feelings. These sensations and feelings can be altered or governed by the mixture of the colors and a keen knowledge of the virtues of each color is necessary if the individual is to materialize just exactly the feelings which he wishes in his office suite.

According to the rules of the scientist, one of the three elements—yellow, red or blue——must be introduced in a color scheme in such a way that its influence will be felt.

The Tiffany style of wall finish is perhaps the most satisfactory in materializing one's color ideas in an office suite. This style is also particularly appropriate for an office where some paint is considered more satisfactory than wall paper. While the general rules of color are to be remembered, it should be borne in mind that individuality should be allowed free rein in order to materialize the individual ideas of the person. A proper recognition of the "accidental" is also valuable, as an accidental color, introduced at the proper place, will set off a room in a manner which is impossible with mere solid or mixed colors.

THE HISTORY OF ORTHODONTIA

(*Continued from page 384.*)

BY BERNHARD WOLF WEINBERGER, D.D.S., NEW YORK CITY.

PH. F. BLANDIN (1836)—*"Anatomie du System Dentaire"* went deeper into the development of the teeth and the influence of dentition upon the face than any of his predecessors. He was probably the first to note the non-eruption of certain teeth and the results therefrom.

"Second dentition is not always accomplished with such exactitude; many circumstances, as I have already indicated, may occur to interrupt it. The permanent teeth sometimes are not formed at the usual time, and those of the temporary set continue to occupy their places. This is a species of irregularity which most frequently occurs, and which may include either the whole series or a lesser number of the teeth."

"All the great molars, when they first make their appearance, are directed obliquely forward, but afterwards take their straight position, when the alveolar arch is more crowded with them."

"The action of the teeth upon the soft parts of the face, reduces itself, in our examination of the subject, to the greater or less tension of these parts, for it does not come within the range of this work to consider the sympathetic affections caused by the development of the teeth. In the fetus the cheeks are placid and make a kind of projection outwards, in consequence of their excess of length, which they hold in reserve to give room to the teeth when they issue from their alveoli. It is this condition of the parts which gives to the face of the new-born infant the disagreeable and almost senile appearance which it presents. The cheeks continue to present this excess of length until commencement of the eruption of the teeth; and if, before this period, the physiognomy loses its disagreeable character, and assumes almost angelic expression so apparent in the face of an infant, and it is in consequence of a deposition of fat in the subcutaneous tissue, and is not the result of any increase of the teeth."

"After the eruption of temporary teeth the cheeks are less full; the face is more elongated vertically than before, and has a much more agreeable expression."

"Up to the time of the completion of the second dentition, the cheeks possess a much greater extent from above downwards before, than posteriorly, which gives them a triangular form. After this period they become more square, in consequence of the depressions of the angle and increase of the rami of the inferior jaw."

"Finally, in old persons, when the teeth are fallen, the cheeks again become placid as in the fetus and the face assumes a much less agreeable expression as the fat disappears; the cheeks no longer having, as in the child, their full rounded appearance."

"The influence exercised by the teeth upon the maxillary bones is very great, and it is necessary to give particular attention to this part of their history."

"The action of the teeth upon the jaws is two-fold; directly, they affect the dental arches; indirectly, the lower border of the inferior maxillary bone, the inferior dental canal, the angle of the jaw, the mental process, the mental foramen, the relations of the condyle and coronoid process, the pterygoid process, the malar tuberosity, and the suborbital foramen."

"Changes Produced by the Teeth upon the Dental Arches.—These changes are affected in the form and dimensions of the arches."

"The maxillary bones are, really, formed into two distinct portions; that which has an immediate connection with the teeth, and the properly called dental portion. The dental part, to which we will direct our attention at this time, is of less extent than the others. With regard to development, it is always in exact relation to that of the teeth; and, like the teeth, it undergoes a series of modifications in early life, which are very exactly repeated at an advanced age."

"The dental portion of the maxillary bones presents itself in the form of a simple trench, almost imperceptible at the period when the development of the germs of the teeth first becomes sensible. A little while after, it is separated into a certain number of alveoli,

common to the teeth of the first and second dentition. Somewhat later, two distinct sets of alveoli for the temporary presents but a single range of alveoli for these teeth. Finally, after the loss of teeth the alveolar portion of the maxillary bones is obliterated, and gradually takes the form presented in the embryo."

"The alveolar arches undergo a series of remarkable modifications, with regard to their dimensions, in consequence of the development of the teeth. In height, they follow very exactly the development of the roots of the teeth, as may be inferred from what has preceded. They are at their maximum of development, in relation to their volume, about the age of five or six years, at which period they give place to the teeth of the first and second dentitions; before and after this epoch, in inverse proportion, with regard to age, they diminish gradually. Considered in relation to their length, the changes are more complicated, the circumstances of which it is important fully to appreciate."

"The extent, in length of the alveoli, is necessarily in proportion to the number and volume of the teeth, to which they give place. It may be asserted, indeed, without fear of contradiction, that, under this relation, the alveolar arches continue to increase from the beginning of life to the full development of the wisdom teeth; and if they do not decrease from that period in length, it is only because they are maintained by the non-dental portion of the bone, which cannot diminish."

"Another question presents itself here, which is a little more complex and a little more difficult to resolve—it is this: Do the twenty anterior teeth of the second set occupy more or less space then or only the same amount of space as the teeth which they replace? Or, in other words, when the first great molar is developed and takes its place in the dental arch, does that portion of the alveolar border, which is anterior to this tooth, undergo any modifications with regard to length? Hunter first proposed this question, and he decided that the anterior portion of the alveolar border remained unchanged; but his theory, so wisely adopted, has not met with the assent of all; Blake and Leveille have advanced a different opinion. This point of odontology deserves to be examined with much attention, as it has a directly practical bearing in regard to the artificial direction of the eruption of the permanent teeth."

"M. Oudet proved, first, that when the secondary incisors appeared, they, being larger than those which preceded them, caused an elongation of the alveolar process, proportionate to their excess of volume, and that the first large molar is pressed a little backwards; he showed, secondly, that after the eruption of the fourth great molaris, the first is again pressed forwards to its proper place, as there is more room, in consequence of the eruption of the second small molaris, which is much less in volume than that which preceded it."

"Finally, to terminate this subject, let us present a consideration which does not appear to have been yet properly apreciated; nature shows by the manner in which she proceeds in the development of the second teeth, that there is to be no increase of this anterior portion of the alveolar arch, for the canine tooth does not make its appearance until the issue of the first and sometimes the second small molaris, and it is, meanwhile, placed out of the dental arch. If it be admitted, that there is an increase in length of the anterior portion of the alveolar arch, as is believed by Blake, then the cause of this particular arrangement is inexplicable. If the opinion of Hunter be admitted, nothing can be more simple. The secondary incisors, larger than those of the first dentition, having taken the place of the canine, the eruption of this tooth is delayed until sufficient space is gained by the change of the temporary molars for the bicuspids, which are smaller."

"After the loss of the teeth, the alveolar arches diminish in length, from behind forwards, and take again the first form they presented. In the child of five years of age they are semi-circular; they are parabolic in the adult and assume again the semi-circular form in old persons.

"Changes Produced by the Teeth Upon the Lower Border of the Inferior Maxillary Bone.—M. Miel first directed the attention of anatomists to this subject. He has shown that the lower border of the inferior maxillary bone is slightly arched upwards, particularly backwards, in the child and old person, but that it is perfectly horizontal in the adult."

"Changes Produced by the Teeth Upon the Inferior Dental Canal.—In the earlier stages of the formation of the inferior maxillary bone, this canal does not exist; the vessels and nerves to which it afterwards gives lodgment now occupy the bottom of the groove, which is the rudiment of the canal. This canal is developed, together with the conduit destined to give place to the vessels of the temporary teeth, when the alveoli are separated from each other. In the adult, this canal is placed about the middle of the bone, between the dental and basilar portions. In old persons, after the obliteration of the

alveoli, the dental canal occupies the superior border of the bone, but it never disappears entirely. In early life it corresponds exactly to the lower portion of the alveoli; in the adult it is placed a little within them, pressed towards this point, according to Cuvier, by the prolongation of the roots of the teeth. During uterine life, and until some time after birth, the dental canal of the first dentition is very large; but from this time it diminishes gradually and finally disappears entirely, when the fall of the temporary teeth is accomplished."

Chapin A. Harris (1839), in *"The Dental Art,—A Practical Treatise in Dental Surgery,"* gives particular and detailed description for the treatment of various kinds of irregularities and in this followed the practice of Fox, whose method, he says, has formed the basis of the established practice of the last twenty-five or thirty years, and this long trial has proved that they were founded upon the knowledge of the laws of economy and practical experience.

He describes an infringement of the laws of growth or disturbances of the functional operation of the jaws resulting in a bad arrangement of the teeth. He also mentions supernumerary and irregular individual teeth; attributes irregularity of the teeth to the narrowness of the maxillary arch, and sometimes to the presence of the temporary teeth.

The work of Desirabode and Delabarre, although published in English anonymously, are supposed to have been translated by Harris. The first editions

Fig. 1.—Appliance of Chapin A. Harris (1839).

of *"The Principles and Practice of Dental Surgery"* (1842, 1844, 1847) and the American edition of Jos. Fox (1846), were based mainly upon the investigation of Delabarre and Fox. However, in 1839 Harris introduced his novel method of using gold caps on the molars as advocated by Desirabode. He was the first to make use of the knobs soldered to the band for rotating teeth, although Delabarre used the small tubes for the same purpose.

It was not until 1850, in his edition of *"Dental Surgery,"* that Harris used the word "orthodontia," and not in 1836. Lefoulon in his work in 1841, translated by Thos. Bond, in 1844, was perhaps the first to use the word *"orthodontosie."*

The work of Harris and the various appliances used by him in his writings on orthodontia will be taken up in detail later on in this work.

Until the discovery in 1839 of the process of vulcanizing rubber, most of the appliances consisted of bamboo, wooden wedges, metallic arches, inclined planes, etc. After the discovery of this important material, regulation of the teeth took on a new interest, innumerable appliances being constructed, which in some sections of the country are common even at this date.

B. A. Rodriguez (1839) in his article, *"On Irregularity of the Teeth,"* published in the *American Journal of Dental Science*, was perhaps one of the first

in this country to treat this subject. He regarded the irregularities of the teeth as deformities of habit rather than natural ones; that where the muscles through long use have been changed, the bones would remain in that position.

Rodriguez invented the metallic plates (illustrated in Fig. 3) which, after the patient had worn for one month, fully answered the purpose intended. "The lateral deformity is radically obviated, as the engraving illustrating the original defect and the remedy will show. But here but one-half of the undertaking was accomplished. After restoring the jaw to its natural form, I found that the upper row of teeth still struck on the interior of the lower, and that whenever the patient separated her lips the same ugly lapping of the lower jaw over the upper was visible. The mouth and teeth presented the reverse appearance, uniformly met with, and resembled strongly the sullen grin of the bull dog. To obviate this, I invented the accompanying instrument (Fig. 2) so arranged that when placed on the upper central incisor of the right and secured to the first bicuspid, it operated as a lever in giving an outward direction to the tooth, restoring it to its proper and natural position. The constant use of this instrument has so far and fully rectified the second difficulty that she now articulates without restraint; enjoys a free use of the jaw and differs in no particular from the ordinary appearance of other persons. Her parents are satisfied and she herself rejoices that art has been able to triumph so singularly over the freaks of nature."

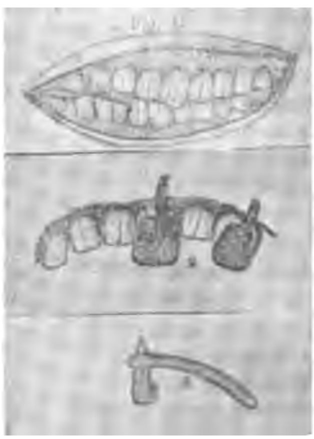


Fig. 2.—Appliance of B. A. Rodriguez (1839).

Fig. 2 is the plate referred to which is made of platina, bent on itself and mounted on two golden caps, and intended to strike on the interior and lateral sides of the incisor and canine tooth of the upper maxillary. By the use of these plates, a forward and lateral motion was given to the jaw, and the deformity thus remedied by its use.

Fig. 3 illustrates a hatchet-shaped instrument, with its longer end curving on itself, forming a loop that enclosed the tooth. At the extremity of the handle are small holes for the insertion of wire, by which means it was lashed to the first bicuspid.

Chas. de Loude (1840) in his *"Surgical, Operative and Mechanical Dentistry,"* writes as follows: "Irregularity is due to the supernumerary teeth, to second teeth being too large and the maxillary arch too narrow, to too early extraction and too long persistence of temporary teeth, to the shape of the maxillary arch, and to heredity, where the child inherits the jaw of one parent and the teeth of the other." Here we find the beginning of this inherited tendency; often spoken of and held to be true until Dr. Angle opened the eyes of the dental profession to what orthodontia really was.

De Loude following the system of Bourdet, shows a splendid conception of occlusion, ending with the following words: "Should this work be received by the profession with any degree of encouragement, it is my intention to publish, at some future date a pamphlet, treating exclusively of the irregularity of the teeth and their management." Having been unable to discover such a work the author is led to believe that the profession in England cared little for this phase of the subject. France was far more advanced, for the next year brought us the work of Schange and Lefoulon.

C. B. A. Lomnitz (1840) in *"Die Lehre von Schiefstande der Zähne,"* differed considerably from his contemporary, Kneisel. He believed that one should not by any means begin to treat irregularities of the teeth before all the teeth erupt and take their places, and that early treatment in many cases causes the teeth to decay and be lost. He also classified conditions according to the distortions of the teeth and unequal proportion of the arches.—(A) General Distortion; (B) Partial Distortion. His treatment differed from Kneisel, though not as practical or as satisfactory.

Brewster, in the November, 1840, issue of *"Gazette des hospitaux,"* was perhaps one of the first to use a rubber plate, which extended from the molar to the anterior teeth, but did not touch those that were to be corrected. Attached to the plate were spiral wires from which ligatures were fastened to the tooth that was to be moved.

In another article, *"La Lancette Francaise,"* Paris, Nov. 14, 1840, Brewster reported another method of treating irregularities.

The article dealt with:

1st. "The anomalous developments of the anterior portion of the superior maxillary bone,—the great obliquity and prominence of the incisive teeth of that bone, and the remedy after two months' treatment."

2nd. "The retraction, on the same subject, of the upper lip: the section of the myrtiform muscle, and the cure."

"A gold plate was fitted to the inner circle of the alveolar process upon the palatine vault: this plate supported a set of spiral springs, which were attached to the disarranged organs, and were intended to exercise upon them by their contraction a gradual drawing of the teeth inwards."

"Although this wonderful change had taken place, as respected the teeth, still the retraction of the lips remained, notwithstanding the recent advantages obtained. M. Blandin, who was consulted by Mr. Brewster, was of the opinion that by an incision made into the myrtiform muscle, and a proper compression adapted, the second infirmity might be remedied."

"The muscle of the lips was seized by pincers, and the section made by

curved scissors. Two elliptical incisions were performed on the mucous membrane of each side of the corner of the lip—this being done, the lip was turned up, and the section of the fibers of the myrtiform muscle given by means of an incision made by gliding along the maxillary bone a short distance. After this operation, the edges of the incision made upon the sides of the curvature, were brought together by means of a suture, and thus the lip was drawn down, the exuberant portion of the mucous membrane destroyed, and this organ enabled to regain its proper form. The whole was kept in its proper position by means of an apparatus made for the purpose by Mr. F. Martin."

"No marring accident took place. The tenth day, the threads were withdrawn, the reunion of the parts was complete; but the apparatus was continued on for some time longer."

J. Lefoulon (1841). *"A New Treatise on the Theory and Practice of Dental Surgery,"* goes more into detail and records more notable advance in practice than any of his predecessors. It seems this work represents the practice and knowledge of irregularities of the teeth, causes, and treatment so well that somewhat extended extracts from his work should be given. It will be seen that little, as to the causes of malocclusion, has been added since the time of Lefoulon, and his paper alone is worthy of retaining.

He was the first to attempt to give this specialty the name Orthodontia and in his work appears the first mention of this particular branch of *Orthodontosie.* Thomas Bond, in translating this work in English, in 1844, changed the ending "osie" and added "ia," and as Orthodontia it has been known since then, although two years previous, 1839, Diserabode, in *Gazette des hospitaux,* called this branch of dental science, Dental Facial Orthopedia.

In describing the various deformities of the jaws and teeth, Lefoulon follows the idea of Maury.

MANAGEMENT OF SECOND DENTITION.

"This subject is, unquestionably, one of the most vexed in dental medicine. With regard to it, opinions, directly opposite, are advanced and defended with equal warmth and equal talent, by men the most distinguished in the art. As for ourselves, long experience, corroborated by the most conclusive facts, observed in a large circle of practice, has led us to form those opinions which we expect to establish by the most satisfactory evidence. But, previously, we must consider some generalities."

"It is, for the most part, children brought up in the large cities in whom the first dentition is affected in a painful and irregular way. Those born, in the country, and the children of the poorer class in town, are favored with a remarkable dentition, not only on account of the facility with which it is performed, and the beauty of the denture, but for the absence of the pain to which others are subject. The reason is plain. The habit of exposure to changes of weather, and of exercise in air, frequently renewed, if not always pure, imparts a remarkable strength to the constitution. But, for the children of the rich, circumstances are very different, at the time when everything should be directed to the development of organs most essential to every part; the result

is, a predisposition to numberless disorders, and an exalted sensibility, which quintuples the intensity of the least suffering."

"We may then affirm, that one means of preventing the accidents of second dentition, is to procure for children, as early as we can, a sound and vigorous constitution."

"But it will not suffice to prevent the disorders which are likely to attend the eruption of the permanent teeth, it is also important to have regard to their symmetrical arrangement. What then are we to do to this end? Are we prematurely to extract the temporary teeth or leave them to the course of nature? And where the negligence of parents has procured for children an irregular denture, must we take away a permanent tooth to facilitate the restoration of the rest to proper order?"

"Let us consider the first of these inquiries, must we extract the temporary teeth? When they fall out with difficulty, when their presence becomes a mechanical impediment to the progress of the permanent teeth, and obliges them to take an irregular direction or growth, we must not hesitate to extract them. Unless we do, we expose the children to deformity, which is much easier prevented than cured."

"Some dentists are afraid that, in attempting to take away the deciduous tooth, they might also extract the germ of the permanent one. This fear is entirely chimerical. Between the fourth and fifth year the germ is destroyed by absorption."

"Nevertheless, it is wrong to remove the milk teeth prematurely, and, without good reason, for if we remove more teeth than can be readily replaced, those of the second dentition, finding more room than belongs to them, may encroach upon the proper space of those that are to come after, and thus induces irregularity more or less deforming. If, on the contrary, we take care not to remove them faster than they can be supplied with exact regard to the space proper to each succeeding tooth, the dentures will be of that symmetrical character which so singularly beautified the mouth."

"There are some dentists, however, who, urged with a desire to operate, make no scruple to extract the first teeth without regard to necessity. What is the consequence? From a child of seven years, for instance, you take away the four incisors; they are replaced. But those which come after them being larger than the first, force the temporary canines to give way before their time. You then remove these canines. Those which are to replace them, finding no longer the resistance which ought to restrain them, shoot up in such a way as to arrange a deformity caused by this meddlesome management, which is but too frequent. Another reason why the temporary teeth should not be unnecessarily extracted is, that their presence contributes no little to the spread of the jaw, or of the alveolar circle which has not yet attained its full dimensions."

"Every day's experience shows us that the teeth, which are at first, to a trifling extent, irregular, will straighten themselves as the circle of the jaw expands. We would urge upon our brethren to take a lesson from nature, who thus re-established the harmony for a moment disturbed."

"As M. Miel has well observed in a treatise, the entire doctrines of which we are far from endorsing, two things may powerfully contribute to irregularity

of the teeth. 1st. A fœtus feebly organized may be borne puny and slender; everything being in accordance with this imperfect state, the germs of the teeth are small. When the time of dentition arrives, it is possible that the constitution of the child may have become more vigorous; the pulps and teeth of the second formation will thence be relatively larger than those of the first dentition."

"Again, the child may have been originally well formed, and its milk teeth have received their full development, but disease, scrofula for example, occurs, which gives to the second teeth unnatural size; these will, of course, be out of proportion to the first. In these cases, it is impossible that the dentition should be regularly performed. The teeth press upon one another and necessarily assume irregular positions. When thus situated, they are not only disagreeable to the sight and in each other's way, but being difficult to clean, they decay with great rapidity."

"Pressed with the serious nature of these consequences, dentists have not failed to suggest and to try means, more or less rational, as they were or were not in accordance with nature. Some viewing the anterior of the arch of the alveolar border, which contains the twenty temporary teeth, as being entirely immovable, stationary and fixed, in the midst of the general growth, can think of no expedient but the extraction of one or two molars, in order to give the other teeth more room to arrange themselves. Others, among whom we confess ourselves to be, affirming that the alveolar arch, like all other parts of our bodies, is capable of extension, oppose strenuously, such a mutilation as the sacrifice of permanent teeth for the better arrangement of the denture."

"Before announcing our views upon this subject, we think proper to prove one thing, in contradiction of M. Miel, that is, that the anterior part of the maxillary is susceptible of development, and that when nature fails to effect it, we may succeed. Here we are compelled to anticipate some things which concern dental pathology in general. For a long time, it has been our habit, when consulted by patients troubled with prominence of the dental arch, growing out of a too near approach of its lateral extremities, to overcome this deformity to apply eccentric force upon the molars of each jaw. But under these circumstances we do not use as complicated an apparatus as when we have to do with extreme narrowness of the jaws. Again, if we observe nothing but too close an arrangement of the teeth, which forces them from their symmetrical relation, we are contented when the subject is a child to introduce the thumbs upon the upper jaw, and by frequent and well managed traction, to force the alveolar arches apart. We perform this operation before the parents and prevail on them, or on the child itself, to repeat it every morning and even during the day."

"Treatment of Congenital and Accidental Deformities of the Mouth—*Orthodontosie.*"

"This branch of dentistry was long in its infancy. The greater part of dentists, ignorant of the facility with which we can impress upon the teeth the direction we wish them to take, imagined that so many difficulties were to be overcome, that they could expect no aid except from artificial luxation. And, as few patients were disposed to submit to this cruel process, it has happened

that this ridiculous plan, having, perhaps, never been submitted to experience, has continued obstinately to hold a place in the annals of science."

"May we, an experimental practician, be permitted to deplore the little knowledge, we will even say the little conscience, with which the greater part of the dentists attached to boarding schools, for the purpose of directing, as they call it, the second dentition, perform their work. Our thorough conviction is, that instead of aiding the accomplishment of the dental evolution, they only interrupt it by their violent maneuvers, which deprive nature of the points d'appui which she has given herself to combine the arrangement of the precious organs of which we treat. Hence, the beginning of all these imperfect and distorted dentures, where the teeth vault one upon another in the most deformed manner. One thing of which they seem to be careless, and utterly without thought is, that the expression of the face, as to grace and dignity depends mainly upon the mode in which second dentition is effected. When through the evils of ignorance they have adorned the jaws with overlapping teeth, the palatine, vault, a true elastic cupola which enlarges or contracts with the enlargement or contraction of the denture contracts upon itself, and thence, my word for it, arise those elongated jaws, and sharp visages, which are so grotesque and unpleasant. Nor is this the greatest mischief. If the person afflicted with this artificial contraction of the palatine arch, be destined, by his superior faculties, to speak in public, his voice is indistinct, and his pronunciation difficult and embarrassed. So that with the most beautiful thoughts, with sentiments the most noble expressed in the most brilliant language, he is cursed with a stubborn and intractable organ which will only imperfectly convey the passionate emotions which he struggles in vain to communicate to his audience."

"See what consequences, to result from one miserable tooth, which an inconsiderate man has prematurely extracted. See the prospect of the whole life blasted. If the victim be a young girl, her face has no longer the beauty and grace which might have governed all hearts and assured her a brilliant position in life. If a young man, his countenance will not display that dignity, which, if he be called to high employment has so powerful influence upon the multitudes; and his voice, as we have just said, will not correspond to his sentiments; it will not give to his words that sweetness and harmony, which adds so much to the value of thought, and impress the mind so powerfully."

"What we say is not idle declamation, but we speak of facts, of which we will furnish the proofs in the course of this chapter."

"To convince young men, who are called to cultivate the dental art, of the truth of our words, it may be useless to tell them what has happened to us in an establishment of the kind already mentioned, of which we took charge. Being solicited by a friend of ours, who is at the head of this house, we readily consented, but upon condition that we should rarely extract a tooth; in other words that we should be permitted to manage things according to our own notions. I contented myself then, with directing them to make traction upon the jaws with the fingers, etc., and I have already advised, in speaking of second dentition. The result was, that without having recourse to the violent extraction of temporary teeth, I had the satisfaction to see that no denture was irregu-

lar, and that there was none of the overlapping, so common in the subjects of these establishments."

"As, unhappily, but little pains are taken to prevent the evil, we will direct our attention to the means of remedy when it exists."

"For a long time the necessity of restoring the teeth in order has been left, but it must be told, that up to the present time, this branch of art has been so imperfect that even in our days we find dentists of the best reputations sacrificing one or more teeth to remedy the irregularity of others. We think that this is paying too dearly for relief from a deformity, very great to be sure, but by no means comparable to the loss of an important organ, a loss which nature herself can not longer repair."

"The dentist then should correct these aberrations of nature, either by hindering their escape from the rules of arrangement prescribed by nature, while they are taking their position, or by forcing them into their proper place when their eruption is entirely completed, and the teeth present deformities, resulting from vice of conformation or want of care."

"We will not repeat the detailed description of the dental arches, which we have already given in the commencement of this book. We will only say that the direction of the teeth is vertical, and that this arrangement is peculiar to the human species. Moreover, the superior teeth should pass before the lower teeth which they cover, and the lower, at least the anterior ones, should incline from before backward. As to the great molars, they fall immediately upon one another. If we look at the length of the teeth in general, they ought to be nearly equal, as should be the triangular spaces that separate them."

"But in the cities, where the population is heaped together in narrow and unhealthy streets, in Paris particularly, nature, faithless to her laws gives way to all sorts of aberrations. Hence the variations, always disagreeable, and often inconvenient, and, sometimes, monstrous, that the practician has called natural disposition of the dental apparatus, before passing to the study of its deformities; for we cannot know how to apply a rational treatment to them, unless the normal conditions be well understood by the operator."

"The principal deformities reduce themselves to the following:

"1st. The teeth often present obliquities, which may be anterior, posterior, or lateral."

"2nd. Sometimes, some teeth undergo a displacement according to their axis, and present a true rotation."

"The dental arches may present three principal modes of vicious relation.

"1st. The prominence, in which the anterior teeth of one or both arches are very oblique, and salient forward. Under these circumstances, the teeth appear very long, and sometimes, the alveolar arches appear to have followed the direction of the teeth."

"2nd. Retrocession, is an opposite deformity to the preceding. Indeed, the subject of it, we remark that the anterior teeth are inclined obliquely backwards. This deformity impedes pronunciation."

"3rd. The inversion of the dental arches, when the inferior jaw passes before the upper."

"In many cases, the teeth, while planting themselves regularly upon the

alveolar border, nevertheless contract anomalies of direction, which must not be confounded with prominence and retrocession. These are the abnormal directions, which are called obliquities, and which are more frequently in the incisors and canines than the others. Sometimes they affect only one or two teeth, sometimes all the anterior ones of one or the other jaw, and constitute repulsive deformities as the following:

"1st. The anterior obliquity which may exist in the two dental arches. Where this deformity exists in the lower jaw, the upper arch instead of overlapping, is itself overlapped, and the two arches, bear an inverted relation to one another. This latter deformity constitutes one variety of the 'galoche' chin."

"2nd. The posterior obliquity also may exist in both jaws. When it attaches exclusively to the upper, it occasions a deformity similar to that just described, the upper range of teeth being overlapped by the under. Another form of the 'galoche' chin."

"Obliquities differ from prominence and retrocession, in this, that in the former the teeth are regularly planted upon the alveolar border, while in the latter the order is more or less imperfect; some being placed too far forward, others backward. When only the two canines of the upper arch project, and the range presents the form so characteristic of carniverous animals, engrenement (to explain the nature of this deformity, it may be necessary to say, that the word 'engrenement,' indicates the mode in which one wheel is made to turn another by interlocking of the teeth of the one into the spaces between the teeth of the other. Trans.) is a consequence of a combination of all the preceding deformities and exists generally with projects, retrocessions and obliquities. It is one of the most obstinate of all the obstacles which we have to overcome and by many dentists is regarded as incurable."

"Such are the principal deformities observed in the dental apparatus; but we repeat that we are far from having named them all."

"The temporary teeth rarely present vicious directions or deviations. Among the permanent teeth, the anterior are, beyond all comparision more subject to these deformities than the posterior. The reason of this is so evident that we need not specify it."

"Among the causes of dental irregularities, we may regard as the most frequent, the neglect of proper supervision of the second dentition. Very often the temporary teeth are too precipitately removed, and often again the opposite error is committed of suffering them to remain even after the permanent teeth have partly appeared."

"There results from this, an error of relation between the development of the palatine arch, and the superior alveolar border, or of the two arches at once relatively, to the size of the teeth."

"Another cause is the bad habit of permitting children to suck their thumb, and to be continually putting their hands into their mouths."

"Another, is the frequently repeated action of the tongue in the pronunciation of certain syllables called lingual, in which that organ, striking against the anterior superior teeth seems to push them forward. This cause gives rise to the anterior obliquity of the upper arch. We may remark that this deformity

is very frequent with the English, resulting from the pronunciation of lingual syllables."

"Shall we remark upon traumatic causes? We must confess that they are rare, but it is easy to perceive, that under certain circumstances, they may determine the luxation and deviation, at the same time, of one or more teeth, and that the restoration to firmness, being accomplished by unaided natural efforts, may result in various deviations."

"But enough has been said about the causes of deformities. The mechanism of their formation is of at least equal importance to the causes themselves. We may readily perceive that when, at the moment of the shedding of the first teeth, a permanent one arriving, finds a space too narrow to contain it, it must press upon the two teeth, which bind it on either side, and if these latter hold their places in the jaw, the edges of the new teeth, gliding upon them as upon inclined planes, must cause them to yield either anteriorly or posteriorly, as the new teeth pierced the gum upon the side of the lips, or upon that of the buccal cavity."

"Let us pass now to the most important part of our subject; the therapeutics of dental deformity."

"But before describing the methods of cure which we daily practice with constant success, let us rapidly review what our predecessors have accomplished."

"Of course the means used to the present time have varied with the nature of the deformity. We will, therefore, rapidly review what has been proposed for each of them."

"Many means have been advised to separate the teeth when too closely approximated. The principal are, the employment of a piece of wood, interposed between them, which, being swollen by the absorption of the fluids of the mouth, will thus press the teeth apart; the employment of the file, and the extraction of some teeth."

"For the simple rotations or deviations of teeth upon their own axis, some have also advised the file, when the deformity depends on want of room. Ligatures, plates and forceps have also been used."

"M. Oudet has advised to luxate them and then to turn them with the forceps while supporting them with the fingers, and confine them in the desired position by a silken ligature."

"We cannot contend too strongly against this artificial luxation. When but one tooth is affected with this deformity, this means is barely practicable, but when all the upper anterior range, and sometimes, the inferior, too, present obliquities forward and backward which caused them to serrate with one another like the sutures of the cranial bones, we would defy any man to maintain and confirm in position all the upper incisors after he had luxated them. The operation is very cruel, and its success exceedingly problematical. In theory it is all very well to fix them with silken ligatures precisely where the operator shall please; but in practice we very much doubt if it would be so easy. The patient is irresistibly inclined to press the point of his tongue against organs uneasy and loose in their sockets, and these touches, often repeated, will be enough to prevent the success of the operation. But there is another difficulty yet more insuperable, for it will not do merely to restore the teeth to position, it is necessary, also, to give them the room they need, and luxation cannot do this."

"It has never entered into the thoughts of other dentists to overcome this difficulty, but we have completely solved the problems for ourselves and that, too, without having recourse to the file, which, indeed, is not to remove deformity, but substitute it by another; for, certainly, teeth once filed never possess the elegant and graceful appearance of those which have never been subjected to this process. In the course of this chapter, we will furnish the proof of what we have said."

"To return to the different deviations. Solitary ones; that is those which affect only one or two teeth, have been combated by metallic threads, wedges of wood, and the inclined plane. The last means has also been employed to remedy the reciprocal interlocking of the two arches."

"For anterior obliquities, or deviations forward, we have been advised to extract the bicuspid neighboring to the canine, and to use metallic thread fixed to an artificial palate. When this obliquity occurs in the lower arch, recourse has ordinarily been to the inclined plane mentioned by Hunter."

"For posterior obliquities, or deviations, backward, which are regarded as incurable by certain practicians, operators have generally used the file, a dental gag or inclined plane. We will not mention artificial luxation, except to refer to what we have already said. We regard it as one of the vain theories constructed in the closet, which even the author never hoped to submit to the touchstone of experience."

"For lateral obliquities, some have advised the application of a ligature, which, being fixed to a neighboring tooth, may gradually draw the erratic one towards it."

"For that total deviation, which rather belongs to aberrations than to irregularities of dentition, the extraction of the tooth is often indispensable, especially when, by its situation it impedes pronunciation, or creates inflammatory conditions, followed by abscess, after having given origin to a tumor, whose nature is not perceived until the pus is discharged, and the tooth exposed. These aberrations are of various kinds, each calling for different management, as may readily be perceived, if we reflect for a moment. They not only result at times from the vicious direction of a tooth in the interior of the alveolus which results in a deviation of the dental follicle, but also from the displacement of the latter, since, as we have already said, teeth have been found implanted upon the palatine arch, the internal surface of the cheeks, the tongue, the pharynx, in the stomach and in the orbit."

"The numerous means we have recounted are far from being sufficient to remedy all the deformities we may meet with, of which we have named the most important, and this fact is so well known to those who have devoted themselves to this matter, that in the books of greatest reputation, the authors frankly acknowledged the incompetence of these means to relieve many of the deformities in question and, especially, the vaulting of one on another, which occasions a deformity, until the present time considered incurable. The case is worse, when the cure being pronounced possible, the treatment begins with the extraction of the two first bicuspids. This operation is the sine qua non condition of every attempt at a cure, and the evulsion of one or more teeth has been advised, at least as an adjunct means, for the remedy of almost every kind of deformity."

"We have long thought that this was to begin in a manner by no means at-

tractive to persons who are to be the subjects of the treatment, and in order to avoid this painful operation, submitted to the more regret, as the teeth, whose extraction is indicated by the nature of the deformity, are generally sound, we have earnestly sought a means, which, avoiding the pain of operation, might yet fulfill the object proposed to be attained by it."

"No instruments or methods hitherto employed being found to answer, our researches had a double purpose, viz., to remedy the deformities of the teeth without extraction, except in some rare and entirely irregular cases; and, secondly, to simplify the series of means to be employed hereafter to combat the deformities of the teeth."

"One consideration has conducted and powerfully aided us in our researches. We have remarked, indeed, that in the immense majority of cases of anterior, posterior and lateral obliquity, the summit of the root was always displaced, or in other words, that these deformities resulted from a vicious direction or disposition of the dental follicle, which produced a tooth situated out of the para-

Fig. 3.—J. Lefoulon, 1841.

bolic line constituted by the dental arch, as appeared to be the case in some instances of prominence and retrocession."

"Thence, it was easy for us to comprehend, that in order to remedy these obliquities it was indispensable that some force, yet to be determined on, acting sometimes concentrically, sometimes eccentrically upon the arch, should be brought to bear upon the crowns of the affected teeth as near as possible to the free border."

"The preceding considerations furnished us with an idea of the proper strings, the application of which has completely confirmed our expectations; and, better still, experience soon taught us to extend their application, and we rapidly acquired the assurance that they constituted a means of treatment for all kinds of dental deformity; whether with or without the peculiar inequality hitherto regarded as incurable; and, besides, that by their employment we might remedy the narrowness of the palatine arch, a discovery which we confess surprised us very much."

"It is now, therefore, a fact in science that the vault of the palate, and, much

less, the dental arches, are not unchangeably fixed in their dimensions, as has long been believed by certain dentists, wiser in theory than in practice. This idea, or rather this serious error, so deeply imbedded in all minds, was one of the greatest obstacles to the progress of orthopedic dentistry. Practicians, firmly convinced that they had to act upon an inextensible circle, found no better means to restore the symmetry of the teeth than to extract one or more of them, or to gain space for one by filing all, which did not contribute a little to narrow yet more the alveolar arch, and to destroy the relation of dimension between the upper and lower jaw."

"The two cases of most common occurrence, are the following: simple inclination, forward or backward, without rotation of the teeth upon the axis or the latter complication."

"In the former case we need only one golden spring, to which we shall give the name passive."

"It is fashioned like a horseshoe, and in such a way, that upon the side it is adapted exactly to the "anfractuosities" of the teeth, and in front, or in the

Fig. 4.—J. Lefoulon, 1841.

center, there is a certain space preserved between it and the teeth we desire to redress."

"We are careful to give it a little more play than the space it is to occupy, and as the metal of which it is composed has elastic properties, it acts incessantly and eccentrically upon the crown of the great and small molars. Its extension is singularly favored by the function of mastication. Now, upon each tooth that we wish to redress, we pass a thread which acts as the active spring, having its 'point d'appui' upon the central part of the passive spring. This is acting upon the supposition that the teeth are inclined outwardly. If the case be different, which generally only occurs in a single tooth, we must place the active spring in front, and the thread will take the place of the passive spring. The two agencies being united, the elasticity of the gold semicircle on the one hand, and the traction of the silk thread on the other, we have a power so great, that if we did not occasionally dispense with it, we might fall into the opposite extreme to the evil we wished to correct. What we say is the fruit of experience."

"In such cases when we not only desire to restore the incisors to position, but to redress some of them which are twisted, we employ a second spring which

consists of a little gold plate, larger or smaller, as we may wish to act on one or more teeth at a time. By the aid of two silk threads, we bind its two extremities upon the great passive spring, so calculating the pressure, that the center of the plate may act only on the border of the teeth we wish to bring into line. Now, we may perceive that in this lever we have a power easily controlled, but constant and irresistible, which cannot fail to reduce the organ to its normal state. In truth, this means has never failed us."

"One of the greatest merits of this method, which is altogether new, is that it gives no pain or discomfort, and, moreover, being constant, it more promptly relieves the deformity than when the instrument employed is only temporarily applied, and exerts only an intermittent action."

THERAPEUTICS,—STRAIGHTENING THE TEETH.

"In our ninth chapter we have considered in detail the manner of remedying general irregularities of the teeth by the aid of extensor and counter-extensor springs of our invention. This means, as we think we have proved, is excellent when we wish to procure an enlargement of the alveolar arch, in order to restore a tooth to its place beside the others when it has been excluded by arrest of development in the arch."

"But it would be irrational to apply this mode of treatment to all cases. It is evident that where only one tooth is turned forward or backward, and that, too, without its neck being out of line, there exists more simple means, already in use by our predecessors, which are abundantly sufficient to correct the evil."

"When the teeth have taken a bad direction, nothing is easier than to act upon them by a slight but continued effort. This is so true, that persons who have one or more teeth filed on account of caries, sometimes produce a partial dislocation of them by the habit of pressing the tongue against the parts in their involuntary efforts to explore the unaccustomed void which is there met with. This fact, attested by experience, has given rise to an erroneous notion, that filing teeth causes these deformities. It can only do so indirectly, in the manner described."

"Of all the means in use to procure the restoration of irregular teeth to their proper position, the simplest is a silken thread passed around the tooth very near the gum; the tooth is soon loosened, and then readily yields to the force which draws towards the proper place."

"We will observe, that, in this operation we have not to overcome a mere vim inertiæ, but an active force, the direction of which must be constantly modified, which is a very different matter. The following is the explanation of the manner in which a thread is generally sufficient to restore a tooth very much displaced forward or backward."

"In order to accomplish this happy result, we fix the thread upon the teeth adjoining that we wish to replace, and make it pass around the latter; and the moisture swells the thread, which shortens, and draws the tooth in the line resulting from the antagonistic action of the two forces which act upon it. After changing or readjusting the thread every two or three days we will re-establish the tooth in the proper position with its neighbors."

"In cases where a tooth is rotated upon its axis, we advise the use of the means we have already described in the eight chapter; that is to say, the greater

extensor spring, which affords a point d'appui more solid than the neighboring teeth, and the little arched plate of gold upon the edge of the teeth which projects outwardly."

"When one or more teeth of the lower jaw are inclined backward, the dental art possesses a means of the utmost energy to force a restoration. It consists of an inclined plane, upon which we force the oblique tooth to bear, by its cutting extremity, in such a way that every movement, masticatory or otherwise, leads it to resume its normal position. The first dentists who used it, contented themselves with a sort of metallic trough in which they enclosed the whole range of inferior teeth, but the alimentary matters which were arrested in this apparatus, produced the serious consequence of producing caries in the teeth submitted to their action, or at least to impart to the breath of the patient a disagreeable odor. M. Delabarre proposed to modify the inclined plane by reducing it to two metallic pieces, a millimeter in thickness, fitted exactly to all the anfactuosities of the dentine, reunited by a narrow bridle at their two extremities, with a piece of gold plate, folded at an obtuse angle, soldered to the anterior piece, one or two millimeters from the upper edge, according to circumstances. It is understood that this oblong plate should be soldered in such a manner as to be in relation to the tooth upon which we propose to act."

"We do not know whether M. Delabarre has had occasion to apply the plan thus modified, but we have tried it very much to the benefit of our patients. It preserves all the advantages of the first means, without its inconvenience. The teeth on which it is applied are perfectly relieved from a harmful envelope, and debris of food imparts no fetor to the breath; for it suffices to rinse the mouth in order to relieve it of all the deposits in the dental interstices."

"Almost all the writers who have treated on this subject have spoken of artificial luxation. This is a means which we have already condemned, and which we cannot too frequently disapprove. The ancients, and some of the moderns who yet imitate them, employed the 'pelican' for this purpose; a violent maneuver, which exposed them to the risk of breaking the tooth at the neck, and thus to replace a deformity by a mutilation a hundred times worse. Besides, it is a cruel operation that should be rejected the instant that mild means can be employed which, at least are equally efficacious."

William Lintott, in *"Structures of the Teeth"* (1841) condemns the extraction or loss of the deciduous teeth, for the permanent ones are sure to be irregular, and the arches underdeveloped. However he favors the extraction of certain teeth in the treatment. He also advocated the use of models and was one of the first to make use of the screw. His work appeared a year previous to Schange's.

"The contour of the features depends essentially on the form of the jaws. A lofty forehead, expressive eyes, and a well-shaped nose, are most effective adjuncts; yet the character of the countenance, as a whole, will be especially influenced by the position of the lower, and due expansion of the upper jaw. When it is understood how far this desirable conformation depends on the arrangement of the teeth, a due importance will be at once attached to their progress, and the proper degree of watchfulness extended to them, particularly as regards the fairer portion of creation."

"Deformity of the jaws may in almost every case be traced to an improper interruption of nature in *prematurely extracting the deciduous teeth.*"

"The first permanent teeth that appear, be it remembered, are the anterior molars, which make their eruption from the gums, close behind the posterior temporary molars. In order to afford a base for these teeth to rest on, the jaw must have elongated backwards. At a later period, the posterior, or second permanent molars, present themselves; and later still, the third molars, or dentes sapientiæ. All these teeth being situated still farther back than the anterior molars, the jaws must have elongated in proportion to the additional space required. Thus it is that the maxillary bone, having been originally semicircular, becomes elliptical."

"When the upper front teeth of the *temporary* set take a direction inwards towards the palate, and by their contact force the antagonizing teeth of the lower jaw outwards, the ultimate result as regards the child, if the irregularity be not corrected, will be the protrusion of the lower jaw which is indicated as *'under-hung.'* Soon after the posterior temporary molars have attained their full height above the gum, or about the fourth or fifth year, an accurate model of both upper and lower jaw must be obtained, from which a casing or capping for the teeth of the lower jaw is to be stamped out of a thin plate of either gold or silver. The capping is to be continued from the first or second molar of one side, round to the corresponding tooth of the other; it must fit closely over the grinding surface of the molars, where it must be rendered thick enough to prevent, by its interposition, the contact of the front teeth; the plate must overlap and fit closely also to the outer side of the molars, and be carried entirely down the inner side, and partly onto the gum; over the canines and incisors, it must extend rather more than two-thirds down, inside and out; opposite the space between the necks of the molars, the plate is to be perforated, so as to permit the passage of one or more ligatures, which, tied around the necks of the teeth, secure the capping firmly in its place. On the ridge of the capping is soldered a thin plate of the metal, edgewise, which must be smoothed off gradually. The whole apparatus being thus prepared, it only remains to so adjust the opposing edges of the capping and the upper teeth, that when properly fixed, the edge of the capping shall, on closing the teeth, just slide inside of each of the six upper front teeth. In this way the pressure exercised by the patient at each closing of the mouth, may be controlled and brought to bear upon such of the upper front teeth as need it, precisely in the required direction; and as the degree of resistance opposed by these will be far less than that of the lower teeth assisted by the molars, it follows that they must gradually give way and be forced outwards."

"The presence of the capping will be productive of a slight irritation of the gums, which will facilitate the movement of the teeth. The patient probably will not be able to wear it continuously, but must endeavor to do so. As soon as the edges of the upper teeth have been brought a little beyond those of the lower, the capping may be dispensed with, for the natural action of the jaws will then be sufficient to perfect the desired change of position of the teeth. A proper expansion of the yielding structure of the upper jaw will follow; the permanent teeth, as they erupt, will assume the same expanded arch, the jaw will solidify with advancing growth, and the threatened deformity will be entirely avoided."

"When the anterior *permanent* teeth of the upper jaw have been allowed to assume this irregular position, they may be moved outwards in the same manner, the capping being fixed to the bicuspids, and, if necessary, to the first permanent molar also; but a more eligible mode of controlling their position is the employment of a light bar of gold or silver, passing round their front surface, by means of which they may be either drawn outwards, or driven inwards, as the nature of the irregularity may demand. The mode of preparing the bar, adjusting and securing it with sufficient firmness, is the same as for the capping already described, excepting that it requires to be fitted to the upper teeth only."

"The capping over the bicuspids, by which the closing of the teeth is to be prevented, and the apparatus fastened, is to be carried well down the external surface, and to this part of the capping the bar is to be soldered, extending from the first bicuspids on one side, round to the same tooth on the other. The inner face of the bar is to be modeled so as to fit closely and evenly to as many of the six front teeth as already stand so far forward as to come up to or beyond the desired position. If none of the teeth are thus far advanced, the bar must be made to describe exactly the line of the arch in which they ought to stand."

"Precisely opposite to the center of each tooth which is to be brought *out*, a strong piece of similar metal must be soldered into the upper edge of the bar: from these points, ligatures of a material known as *'Indian twist,'* are to be passed round the necks of the irregular teeth, and drawn daily closer and closer, until the teeth, yielding to the constant pressure thus brought to bear on them, approach the bar, and assume their proper position."

"When any one or more teeth project beyond the right line, and it is desired to move them *inwards,* a small hole must be drilled through the bar, over against the most prominent point of each; a screw-thread is then to be cut, and a short screw introduced, which, working through the bar, will, by a turn or two each day, keep up such a continued pressure against each tooth as will quickly force it back as desired."

"The projection of the screw-heads must not be so great as to cause annoyance to the lip, and longer screws must be kept ready for use, in order to reach the teeth as they recede from the bar."

"In this manner any required movement of the teeth, inwards or outwards, may be effected with great ease, and in a very little time, causing no serious annoyance to the patient, the whole apparatus being removed and cleaned every two or three days. By shifting the point of attachment of the ligature, or the direction of the screw, the force may be brought to bear in a lateral course, if requisite. Care must be taken that the application of the force thus acquired is so distributed that the resisting power of those teeth to which the bar is fixed shall be much greater than that of the teeth under treatment; and if necessary to secure this, one or two irregular teeth only should be acted on at the same time."

"I have stated the age of fourteen or fifteen to be the period at which I would recommend the use of mechanical means to control the arrangement of the teeth, excepting in case of evident malformation, or wherein injury is resulting to the teeth from improper contact, when assistance should be secured sooner. In all ordinary cases, the alteration may be almost as easily effected at the age of twenty as at fourteen. At this advanced period, the jaws will have

attained their full growth, and it will be evident, if irregularity still continue, that Nature requires, in this instance at least, the assistance of art."

Solyman Brown, in 1841, prepared his *"Essay on Regulating the Teeth"* at the direction of the American Society of Dental Surgeons, which was intended to be given to the parents in order to prevent irregularities of the teeth in the permanent set.

"If a beautiful and regular arrangement of the teeth, contributes in no small degree to the pleasing expression of the human countenance, so, with equal cer-

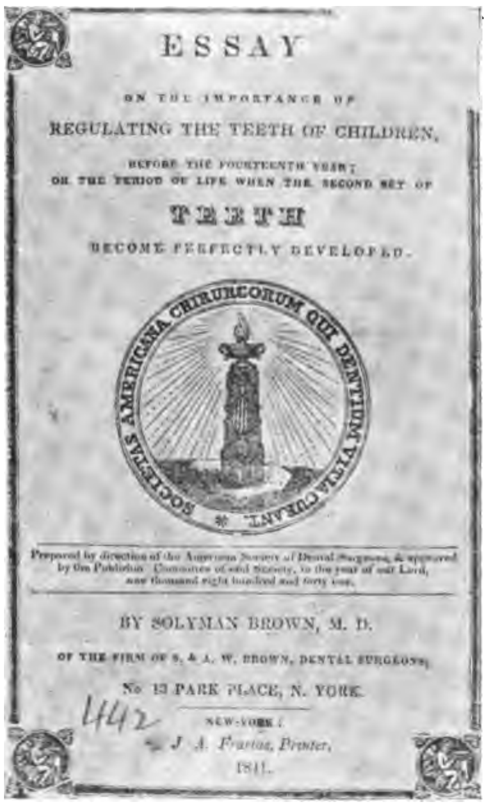

ESSAY
ON THE IMPORTANCE OF
REGULATING THE TEETH OF CHILDREN,
BEFORE THE FOURTEENTH YEAR;
OR THE PERIOD OF LIFE WHEN THE SECOND SET OF
TEETH
BECOME PERFECTLY DEVELOPED.
SOCIETAS AMERICANA CHIRURGORUM QUI DENTIUM VITIA CURANT.
BY SOLYMAN BROWN, M. D.
OF THE FIRM OF S. & A. W. BROWN, DENTAL SURGEONS,
No 13 PARK PLACE, N. YORK.
442
NEW-YORK:

Fig. 5.—Title page "Essay on Regulating the Teeth."

tainty does their malarrangement obliterate no inconsiderable portion of the attractive charms of the finest features."

"Can mothers then be so indifferent to the happiness of their children as to give this subject but a passing thought? Will fathers who spend their lives in the effort to amass fortunes for their offspring, do absolutely nothing to give value to the patrimony which they bestow?"

"Let parents then see to it that the second set of teeth more particularly, are not allowed to take false positions in the mouth. If any protruding tooth is discovered to make its appearance either within or without the dental arch, the judgment and skill of an experienced dentist should be put in instant requisition; because

"First: No other known species of animal is found to be as subject to derangement and irregularity of the teeth, as the human race."

"Second: No other part of the physical system of man is as liable to constitutional and accidental malarrangement as the organs of mastication."

"Third: This malarrangement of the teeth of the human animal, by which the race of man is distinguished from every other species of organized beings, is the result of mismanagement or of evil hereditary tendencies, most of the effects of which may be easily remedied, or altogether countervailed."

"Fourth: The measures to be pursued in order to apply the best available remedy to this evil, must be taken at the proper time or they become inoperative."

"Fifth: No other known species of animal, is found from history, observa-

Fig. 6.—Solyman Brown, 1841.

tion and experience, to be as subject to derangement of the dental organs as man."

"Sixth: That the social and individual habits of man are constantly subjected to more sudden transitions and to a greater departure from the laws of his nature than those of any other animal."

"Seventh: As no irregularity of any importance ever takes place in the first set of teeth, it may be readily conceived that the derangement of the second set is frequently occasioned by the too tardy absorption of the roots of the infant, or milk teeth, from whatsoever cause this nonabsorption may result; for if the first or shedding teeth are not removed at the proper period, the teeth of the second or permanent set will be forced out of their true position and compelled to take up their station either within or without the natural arch."

"Eighth: No other portion of the human physical system is found to be as

subject to constitutional and accidental malarrangement and disorder as the organs of mastication."

"If irregularity of arrangement and the unseemly appearance, consequent thereon, were the only ill effects of this deviation from the laws of nature, the philanthropist would find less reason for sympathy, and the professional dentist less apology for urging the importance of the subject; but the truth should not be concealed, that a very considerable proportion of dental diseases result from this single source."

"The difficulty of removing tartar and other foul accretions consequent upon this jumbled condition of the teeth, would of itself constitute a powerful objection to this state of the mouth; but this is one of the smallest difficulties. When the teeth lose their natural arrangement, they also lose their natural support. The form of the arch assumed by the teeth in their natural position, operates as a powerful means of keeping them in place in spite of the great mechanical force to which they are subjected in the act of mastication."

"Ninth: All these evils may be counteracted by the application of remedies well settled among the established principles of dental science in its present improved condition, in our country."

"It might not be deemed an attribute of wisdom to utter useless complaints in regard to the incurable maladies incident to human nature. To bear them with unrepining fortitude would be the true philosophy. But inasmuch as the evils of which we speak are not unavoidable in their character, nor attended with much expense or suffering in their complete removal, I may be allowed to awaken all the solicitude in the minds of my readers, which the importance of the subject demands; and I may ever with the strictest regard to truth, that few subjects connected with merely the physical well being of man, demand more justly his solicitous regard."

"The age of fourteen or thereabouts, at which epoch the permanent teeth become fully developed, is the period at which the operation of regulating the teeth should be fully completed; yet in case of unavoidable neglect or thoughtless procrastination, many writers tell us that the age of eighteen or even twenty, is not wholly beyond the range of successful operation."

O. Thon, in *"Von der Verschieden Abweichungen in der Bildung der menschlichen Kiefer und Zähne"* (1841), made the following observations concerning the position of the teeth, classifying them as follows:

1. Teeth in irregular positions.
2. Teeth out of alignment.
3. Imparted teeth.

In regard to the arches:

1. Projection of upper jaw.
2. Projection of lower jaw.
3. Projection of upper teeth.
4. Projection of lower teeth.
5. Projection of teeth associated with hair-lip or cleft palate.
6. Open bite.

J. M. A. Schange (1841) *"Precis sur le redressement des dents,"* etc., follows closely the idea of his countryman Lefoulon. He describes the development of the teeth, their eruption and the procedure of the eruption of the per-

manent teeth. He, like many of his contemporaries, did not favor the extraction of the deciduous teeth, but did not agree with Lefoulon that the arch narrowed on account of this.

Schange mentions three ways of obtaining space in correcting irregularities. First, by filing, which he disapproved of. Second, extraction, which allows too much space. Third, by the enlargement of the arch.

He also devised a form of anchorage, a marked improvement over the crib of Delabarre, because of its simplicity and smaller size. It consisted of pieces of wire or narrow strips of gold bent to conform closely to the necks of the two or three teeth that is surrounded, with a spur attached to rest on the occlusal


PRÉCIS
LE REDRESSEMENT DES DENTS,
EXPOSÉ
LES DÉVIATIONS DES DENTS;
PARIS.

Fig. 7.—J. M. A. Schange, 1841.

surfaces. This space was used primarily to prevent the crib from slipping and irritating the peridental membrane. It thus served a different purpose than the one of Delabarre, in that it was not intended to interfere with occlusion, but for the purpose of anchorage, and in securing the ligatures.

Schange also described three kinds of ligatures—silk, linen or grass line, and fine platinum or gold wires. He was not in favor of metal ligatures, on account of the difficulty of attachment, but preferred the silk or grass line, for they absorbed moisture and required little attention.

Numerous appliances were devised by Schange. In connection with these, mention must be made of the screw as used by him. For the first time, we find

the screw applied in regulating appliances on a clamp band, although having been used previously, in direct movement of the teeth, as a threaded wire by Delabarre; by Lintott, Carabelli, and others. "The honor of the introduction" (of the screw) "of which has been erroneously divided between Dwinnell of New York, Gaines of England" and Schange of Paris.

Fig. 8 shows the anchorage used by Schange with a lingual hook.

Fig. 9 illustrates Schange's crib with a palatal wire and plate, showing one method of correcting protrusion of the upper anterior teeth.

Fig. 10 is a modification of the crib, with buccal and labial arch, or band as it was then called, a combination of the screw and ligatures.

Fig. 11 is another modification of the screw adopted by Schange, but not with much success. This was tightened by means of a watch key.

Fig. 8.

Fig. 9.

Fig. 8.—Anchorage used by Schange, also the introduction of the lingual hook.

Fig. 9.—Crib of Schange.

Fig. 10.—Appliance as used by Schange to correct irregularities of the teeth.

Fig. 12 shows the first application of the screw as a clamp band. A marked improvement in the anchorage, although applied to the malposed tooth instead of being used entirely as anchorage. Attached to the lingual surface was a hook, with a ligature of silk brought around the molars and back to the hook. The opposite side shows this same application of the ligature, but attached to the labial surface. Anterior to the molars and over the ligatures were two rings of gold wire. By shoving these rings towards the molars, Schange supposed the rotated central could be turned.

Fig. 13 shows another application of the anchorage with a metal bar extending from molar to molar both buccal-labially and lingually. The external

bar was adjusted away from the teeth in order to apply ligatures. On the inside bar were attached two inclined planes of gold.

Fig. 14 shows Schange's crib, with the first direct application of force against the anterior teeth by means of India rubber. The elastics were fastened upon hooks attached to the crib and applied tightly in front. We thus learn that rubber was used in orthodontic treatment prior to the time of Tucker.

In connection with this appliance, usually credited to Lachaise, but truthfully one of Schange's own, we find the first attempt at retention after the teeth have been moved. In this connection Schange says, "It would be wrong to think that once the teeth are brought back to normal position, the whole treatment is completed. They must be kept in the place assigned to them, for a long time after treatment, in order that they may acquire the proper firmness, especially if the treatment has progressed for a considerable length of time. For this purpose I use a rubber band attached to some hooks on the appliance surrounding the molars. This little apparatus was suggested to me by Dr. Lachaise,—and completely served my purpose."

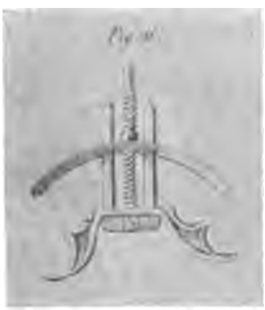


Fig. 11.—Modification of the screw by Schange.

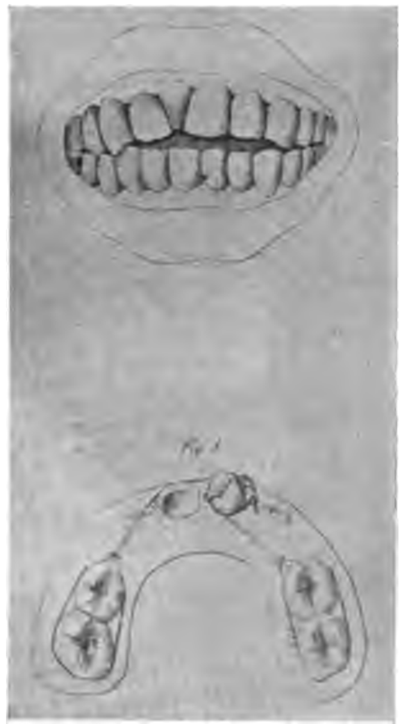


Fig. 12.—First application of the clamp band and another modification of the screw.

J. S. Gunnell, in the *American Journal of Dental Science* (1841) reported (p. 65) "A Remedy for the Protrusion of the Lower Jaw." Under Kneisel, we have already described the use of the chin cap, and he perhaps was the first to describe the use of same for the treatment of protrusion of the mandible. Nevertheless, Gunnell lays claim to having used this method as far back as 1822, at the suggestion of H. H. Hayden.

Occipital anchorage obtained from the use of the head gear, for the protrusion of the mandible, we find was thus introduced by Kneisel, although used by Gunnell in 1822 or 1823, then by Schange and not by Kingsley in 1886. The first application of the chin-cap was by Cellier in 1802 and Fox in 1803 not as an anchorage but "to prevent accidents from happening in the extraction of teeth."

"About the year 1822 or 1823 my attention was called to the necessity of some plan, whereby the protrusion of the lower jaw (called jimber or morose jaw) should be restored to its proper situation so that the under teeth (in front) would close under and posterior to the upper ones, thereby forming or restoring natural appearance of the human mouth. I found in all such cases that by the strongest sufferable pressure with the hand on the chin, the jaw could not be pressed back so as to bring the under teeth into their natural relative position to the upper ones. I set about discovering some remedy more convenient and expeditious than any then known."

"In a conversation I had with Dr. H. H. Hayden, about the above period,

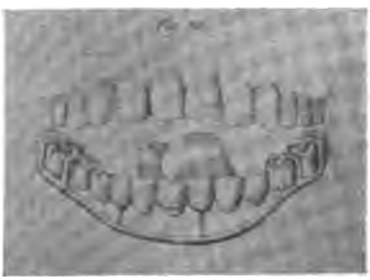


Fig. 13.

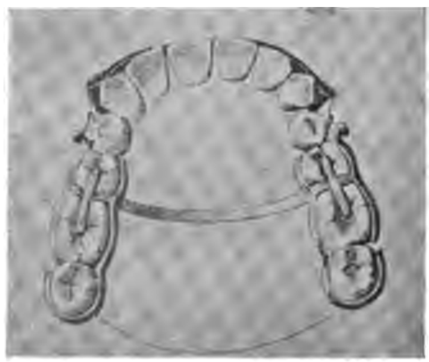


Fig. 14.—First direct application of force by means of India rubber. This apparatus usually credited erroneously to Lachaise.

he advised pressure by straps, extending from the chin to the back part of the head, etc.; but finding them very difficult to retain in place, I determined to use Mr. Joseph Fox's bandage, or cap and straps, which he used for the prevention of the sudden luxation of the lower jaw from gaping."

"The protrusion of the lower jaw, or natural partial luxation, if I may use the expression, sometimes occurs from nature's imperfect operation, but seldom takes place before the cutting of the second set of teeth, though I have seen it exist in several cases previous to that period."

"But the most common time for the occurrence of the protrusion of the lower jaw is soon after the commencement of second dentition. It is caused at this period by the teeth coming out irregularly so that the teeth of the upper jaw strike upon or just inside of the edge of those of the lower. The consequence is, that when the jaws are brought together the lower jaw is forced forwards, producing partial luxation at the tempero-maxillary point. This can be entirely prevented by timely extraction of the infant teeth, and pressing the adult teeth in their proper places, etc."

"To restore the jaw thus deformed, I proceed by tying a small block of ivory on one of the lower jaw teeth, so as to separate the teeth in front about one-quarter or one-eighth of an inch. I then put on Fox's bandage, and buckle or draw it as tight as the patient can bear with convenience, which produces pressure on the chin upwards and backwards, and then in case the teeth are irregular take a piece of tough wood of the shape of a narrow spoon handle, introduce it between the teeth, and press it on the outside of the front lower protruding tooth or teeth and on the inside of the upper irregular teeth, firmly for from five to ten minutes, two or three times a day, the lower end of the stick or piece of wood and the hand being below the chin, thereby pressing the lower teeth inwards and backwards, and the upper teeth outwards and forwards. In this way I have restored the face or jaws to their proper symmetry in one week, though occasionally it will take from three to six weeks or even longer."

"The operation of the bandage or cap and straps and block of ivory, is to press the joint ends of the lower jaw backwards and downwards, and press the chin backwards and upwards, the block of ivory between the back teeth or molars acting as a fulcrum."

"This operation is best performed as soon as the deformity occurs, though it is performed with great certainty until puberty. And I have resorted to it much later, but the difficulties increase very much after the patient is sixteen years of age."

(To be continued.)

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID MCCOY, D.D.S., EDITOR,
LOS ANGELES, CALIF.

A COMPARATIVE STUDY OF THE ATTACHMENT OF THE TEETH OF LOWER ANIMALS

BY E. H. SKINNER, M.D., and MARTIN DEWEY, D.D.S., KANSAS CITY, MO.

IN the study of the evolution of the dental apparatus, there is no feature more interesting than the process of attachment which the teeth of the lower animals have passed through up to the present time. The attachments of teeth as we find them in existing animals may be considered to be the form which is better suited to the animal's need at the present day than some of the attachments which existed in times past.

In studying these various tooth attachments, it must be remembered that the dental apparatus of the animal has played a very important role in the preservation of the animal's life. It must also be remembered that the attachment of the teeth has, to a certain extent, been influenced by the type of the tooth, the manner of tooth forms, and the usage of the tooth. In other words, an attachment which has been found perfectly satisfactory in one animal would be a decided failure in another. Therefore, in the study of tooth attachment, the fact must not be lost sight of that the attachment of the tooth is, to a certain extent at least, subservient to the use to which the tooth is put, as is also the manner of eruption or growth of that tooth. In other words, some of the animals in which a certain type of tooth attachment has been extremely successful have managed to get along with that kind of attachment because other factors entered into the perfection of the dental apparatus. In fact, if space would permit, it would be very easy to prove that the entire life of the animal at some stage, if not at the present time, has been dependent entirely upon the dental apparatus, associated with which have been several forms of tooth attachment.

In studying the attachment of the teeth as found in the modern animals, we must remember that forms of tooth attachment have probably existed which have been intermediate steps in the forms that we have today, and probably some types have entirely disappeared owing to the unsatisfactory conditions prevailing at that time. Therefore it would not be difficult to imagine that during a short period in ancient times certain animals existed in which the tooth attachment was not satisfactory to their needs. Consequently such animals have disappeared and we find only a few of them as fossil remains. In some of the fossils, we have found tooth attachments which are dissimilar to any existing at the present time.

Fig. 2.
Radiographs of teeth of shark.

Fig. 1.

It is our intention in this article to confine ourselves to the discussion of modern living animals and show how the radiograph reveals the anatomical structure very satisfactorily and, of course, does not mutilate the anatomical structure.

Fig. 1 is a radiograph showing the teeth of a shark attached by fibrous

membrane. In tooth attachment and plan of tooth succession, the dental apparatus of the shark represents a very primitive type. The teeth of the shark rise in continuous succession and are developed from the thecal fold and are of continuous numbers. Consequently, we find the fibrous membrane attachment a success because the teeth are held insecurely to the cartilaginous jaws, and, if one or two, or even fifteen or a hundred, are pulled out, say on Tuesday, they will have a new row of teeth for use ready by Thursday. Therefore, the real success of the shark's dental apparatus does not depend upon the type of attachment but upon the continued succession of teeth. This is one example where a certain type of tooth attachment is successful in one animal, but which would not apply to the higher animals that have a limited number of teeth.

Fig. 3.

Fig. 4.

Radiographs of upper and lower dental apparatus of scaridæ.

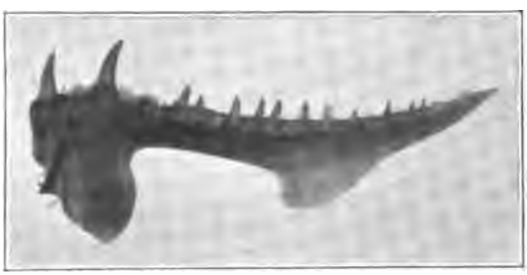


Fig. 5.—Radiograph of dental apparatus of wolf-fish.

Fig. 2 is a radiograph showing the shape of the base of the tooth of an extinct shark, which is imbedded in the fibrous membrane. The teeth in this case were, of course, lost in large numbers during the life of the shark.

The teeth of the shark also represent a type of dental evolution in which all the teeth are of the same shape and the animals are known as homodonts, which is a characteristic type of denture found in the fish.

Figs. 3 and 4 represent the upper and lower dental apparatus of the parrot fish, or scaridæ, which also has a type of dental apparatus of continuous succession, and one in which the teeth are all similar. These teeth are also attached by fibrous membranes, and to a great extent these membranes become calcified between the teeth, as a result of which the teeth are developed one upon the other in very much the same manner as a brick wall is made up of bricks

piled up one upon another. The upper row is eventually broken away, and the lower continues to succeed and push the others up, always presenting an incisal edge made up of a large number of teeth. This animal is also a homodont.

Fig. 5 shows the dental apparatus of a wolf-fish, so named because of the two large caniniform teeth situated in the anterior region of the upper and lower arch. It will be seen that these large caniniform teeth present a different appearance than do the smaller teeth, which are located farther back in the arch. The large caniniform teeth are merging into an ankylosed attachment, there being a calcification of the tissue between the tooth and the jaw, forming a sort of a bony network, and it will be seen that the base of the tooth merges into the jaw without any perceptible line between it and the tooth. Therefore, it would appear that the ankylosed form of tooth attachment is the second stage in the evolution of the attachment of the teeth as we find them in the present-day animals.

Fig. 6 represents one-half of the mandible of the gar-pike, which possessed a large number of small teeth, and several large teeth located in different positions on the mandible. From an examination of this radiograph it will be seen that the attachment of the large teeth presents a different appearance from the

Fig. 6.—Radiograph of half of mandible of gar-pike.

attachment of the large teeth of the wolf-fish; in other words, a slight membranous attachment still exists between the large tooth and the mandible; the tooth is not as firmly ankylosed in the gar-pike as are the two caniniform teeth in the wolf-fish. This proves that there were various stages of evolution between the fibrous membrane and the ankylosed tooth in former times and also that some are existing at the present day.

Fig. 7 is a radiograph of the teeth of the sargus which are all attached by fibrous membranes. This specimen is more interesting because of the hetrodontism of the dental apparatus, than of any evolution in the tooth attachment. The posterior teeth are round and are used for crushing, while the anterior teeth are very highly developed into incisiform teeth, which are used for incision by the sargus in securing its food.

Fig. 8 shows the beak of the sawfish in which there are a row of teeth located on each side of the bony projection from the premaxillary bone. These teeth are imbedded in a socket and grow from a persistent germ. The embryonic condition of the root of the tooth is very easily revealed by the radiograph, and the wall of the alveolus of the tooth is also outlined. These teeth are of continuous growth and increase in size during the life of the animal; they continue

to grow larger as the animal grows larger. This represents one of the earliest types of a tooth of persistent growth imbedded in a socket.

In Fig. 9, which is a radiograph of the head of a pickerel, we find two types of tooth attachment. The large teeth which are seen on the mandible are attached by ankylosis, while the teeth on the vomer and palate in the upper jaw are attached by fibrous membrane. The large teeth are used primarily for prehension, while the teeth attached by fibrous membrane on the palate and vomer

Fig. 7.—Radiograph of teeth of sargus.

Fig. 8.—Radiograph of beak of sawfish.

Fig. 9.—Radiograph of jaws of pickerel.

are used for deglutition. This represents another example of the evolutionary changes brought about in the use and position of the teeth. It will be seen that the maxilla is very small and carries no teeth.

Fig. 10 is a radiograph of a skull of a turtle, here shown because it has some interesting features owing to the fact that the turtle is entirely edentulous. Fig. 11 shows the mandible of the turtle, and the mandible and maxilla are covered with a calcareous plate, which performs the dental functions of the animal. This

Fig. 10.—Radiograph of skull of turtle.

Fig. 11.—Mandible of turtle with calcareous plate removed.

calcareous plate is really attached by a fibrous membrane because in a dry specimen it can be easily removed. Fig. 12 is a radiograph of the calcareous plate which has been removed from the mandible shown in Fig. 11.

The armadilla, a radiograph of which is shown in Fig. 13, has a very primitive apparatus so far as the occlusion of the teeth is concerned. In this species the teeth are conical-shaped and, in shape and form of attachment, very much resemble the teeth of the sawfish; they are imbedded in a socket and have the same diameter at the root as at the crown.

As we pass higher in the animal kingdom, we find that the teeth of the

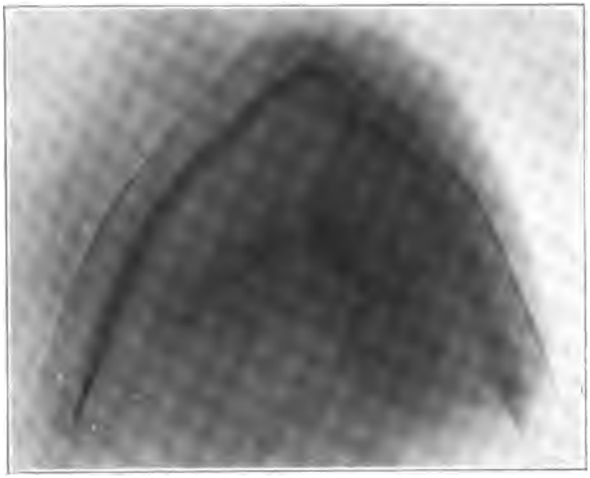


Fig. 12.—Radiograph of calcareous plate of mandible of turtle.

Fig. 13.—Radiograph of skull of armadilla.

animal become more complicated as regards both tooth attachment and form of the dental apparatus. As to the zoological classification of an animal, it might be said that the entire anatomy does not necessarily progress with the dental apparatus. An example of this is the kangaroo, a radiograph of the teeth of which is shown in Fig. 14. The kangaroo has a very highly specialized dental apparatus both as to the shape of the tooth and the manner of tooth attachment. In an examination of the mandible, it will be seen that the lower incisors are set horizontal to the body of the mandible, with the cutting edge projecting for-

ward, and the root of the incisor is turned directly towards the molars and premolars instead of being perpendicular to them. The upper molars and premolars are attached in the socket by means of peridental membrane, or by what is known as *gomphosis*. Fig. 15 shows the occlusal view of the mandible and the maxilla of a kangaroo, and the position of the attachment of the lower incisors is also very closely shown.

Fig. 14.—Radiograph of skull of kangaroo.

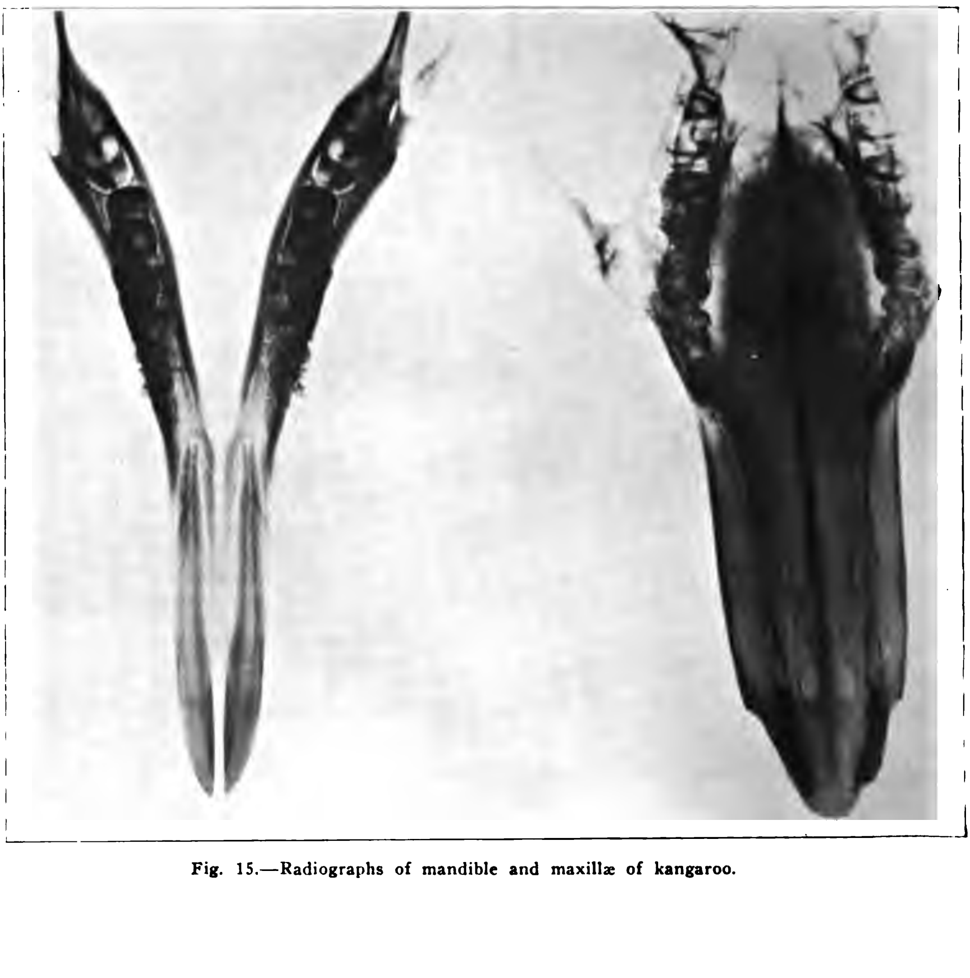


Fig. 15.—Radiographs of mandible and maxillæ of kangaroo.

The teeth of the rodent present a very interesting study of attachment, which is also influenced by the manner of tooth eruption or growth. Fig. 16 is a radiograph of the mandible of a woodchuck in which the large lower incisor grows as the result of a continuous tooth germ. This incisor is imbedded in a socket and the attachment of the tooth continually changes as the tooth continues to grow forward. The upper molars and premolars are attached by means

Fig. 16.—Radiograph of mandible of woodchuck.

Fig. 17.—Radiograph of mandible of squirrel.

Fig. 18.—Radiograph of skull of squirrel showing excessive growth.

of peridental membrane and a socket, but are not of continuous growth, consequently the attachment is not changing as rapidly as it is in the constantly erupting lower incisor. The radiograph also shows the lines of calcification in the mandible in such a manner as to overcome the stress of tooth and muscular attachment. It is interesting to note that the greatest stress on the point of the lower incisor must necessarily be downward, but as the alveolar process is extremely thin on the labial, or under side, the tooth is really supported by the

Fig. 19.—Radiograph of skull of mountain lion.

Fig. 20.—Radiograph of skull of hyena.

peridental membrane and the attachment from the upper, or lingual side, and not by the development of bone on the lower, or labial side. The arrangement of the bony structure in this case indicates that the teeth, when attached by

gomphosis, receive their real support from the fibers of the peridental membrane, which are attached to the bony wall, and not from the bony wall independently and separately from the peridental membrane.

Fig. 17 presents not so much a study of a tooth attachment as it does an interesting feature in the growth of teeth, which are of continuous growth. These teeth must possess occlusion and be worn down in order to prevent the condition shown in Fig. 18.

Passing from the rodents to the carnivorous animals (see Fig. 19, a radiograph of a skull of a mountain lion), it will be noticed that the teeth are attached much more firmly because they are subject to a great amount of stress, and are not of continuous growth. Attention is called to the extreme heaviness of the attachment around the molars and premolars and canines in both the

Fig. 21.—Radiograph of teeth of bear.

upper and lower arches. Comparing Fig. 19 with Fig. 20, which is a radiograph of the teeth of a hyena, it will be noticed that the extreme heaviness of the tooth attachment is in the region of the molars and premolars, which are the teeth that are subjected to the greatest amount of stress and use. The canines of the hyena are used very little. They are under-developed and their attachment is much more insecure than that of the molars and premolars, which are used for crushing.

Fig. 21 shows a radiograph of the skull of a bear, which also presents an interesting study from a comparative standpoint when compared with Figs. 19 and 20. Owing to the peculiar food habits of the bear, the dental apparatus of this animal differs considerably from that of the mountain lion or the hyena, and consequently the teeth are of a different shape, and the attachment also

shows a different amount of strength. Because of the omnivorous habits of the bear, the dental apparatus is not as strongly attached as it is in either the lion or the hyena. This difference, or weakness, in attachment can be seen by the manner in which the rays penetrate the teeth and the alveolar process.

Fig. 22.—Radiograph of skull of wolf.

Fig. 23.—Radiograph of an antelope, showing hypsodont teeth attached by gomphosis.

Fig. 22, a radiograph of the teeth of a wolf, also shows a light development of process around the teeth and jaws, indicating that the dental apparatus is not put to any great amount of strain, for the development of alveolar process is exceedingly light.

The herbivorous animals representing that great class of plant eaters of which the deer, antelope, and cow are living specimens, have a tooth attachment which is a modification of that found in the carnivorous animals, or a tooth which is not of continuous growth, and one such as is shown in the incisors of the rodent. The teeth of the herbivorous animals are known as hypsodont

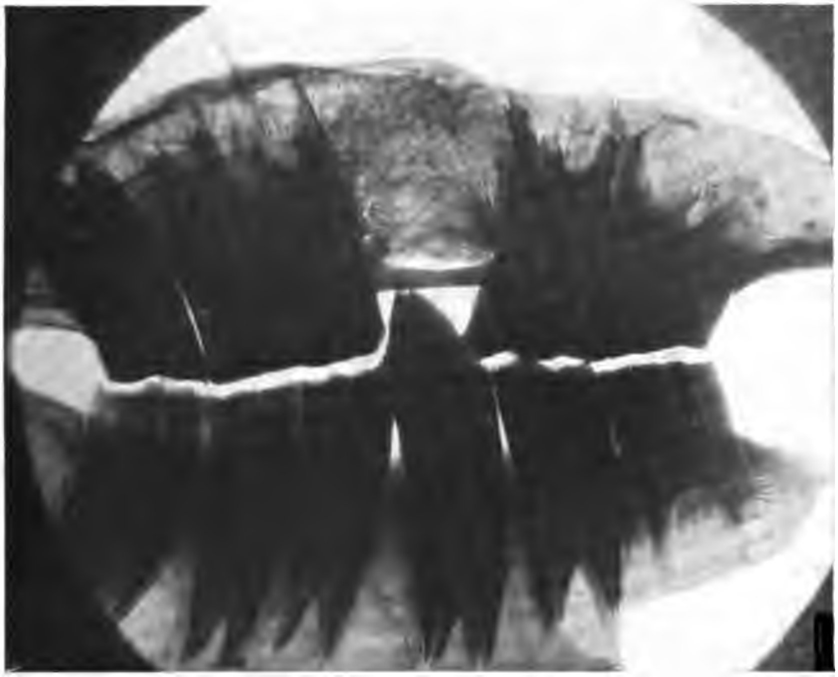


Fig. 24.—Radiograph of jaws of buffalo (*Bison americanus*), showing missing molar.

Fig. 25.—Radiograph of mandible of a young horse.

teeth, or teeth which are of continuous eruption. It will be seen in Fig. 23 that the molars and premolars present crowns which are of considerable length, or, in other words, the crown extends down in the alveolar process a considerable distance, and the root is short. The diameter of the tooth is about the same from

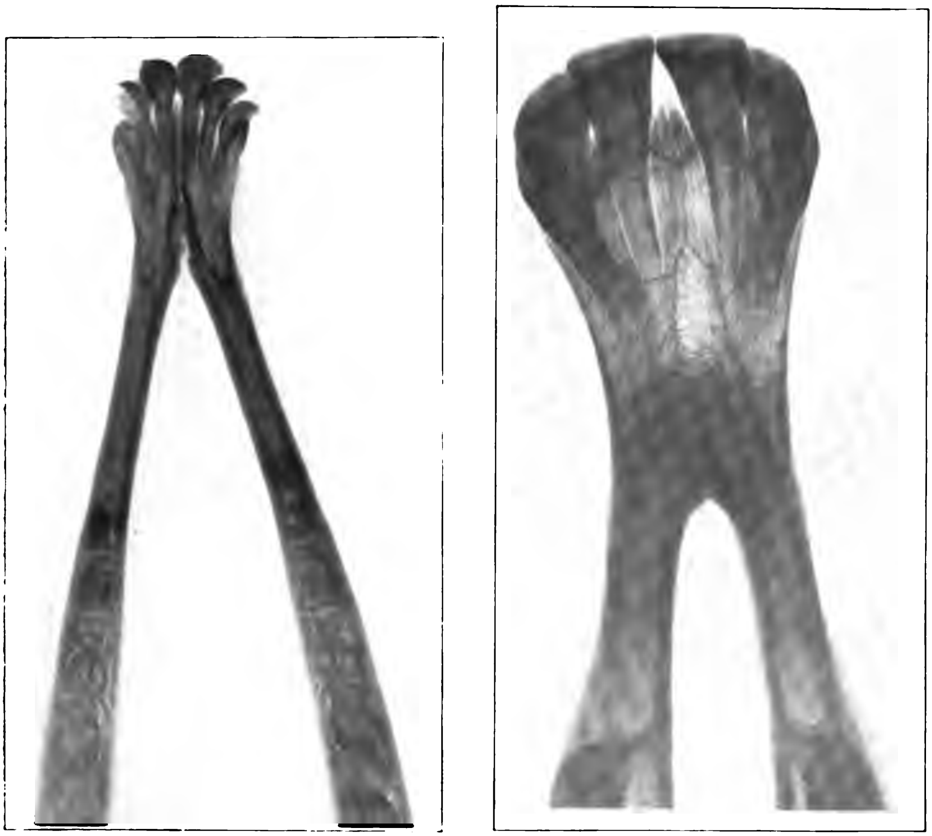
Fig. 26.—Radiograph of mandible of an old horse.

Fig. 27.—Radiograph of teeth of wild hog.

the occlusal border down to the root. As the occlusal surface is worn off, the tooth continues to erupt, and consequently the crown of the tooth continues to become shorter as the animal grows older. An example of this form of tooth

attachment and the continuous eruption of the tooth is shown in Fig. 24, which is the mandible and maxilla of a buffalo that had lost one tooth above, and the lower tooth continued to erupt without the subsequent wear which we see on the other teeth.

As an example of the continuous eruption of the teeth, Fig. 25, the mandible of a young horse, shows the permanent molars in a state of formation at the apical end, and the extreme length of the crown of the tooth as it is first formed. As the animal grows older, the teeth continue to erupt, as shown by the radiograph of the teeth of an old horse (Fig. 26), and the lines of calcification of



A. B.

Fig. 28.—*A*, Radiograph of mandible of antelope; *B*, Radiograph of mandible of horse.

the original tooth socket can be very easily seen. The amount of bone filled in as the result of the eruption of the teeth can also be outlined very clearly.

Fig. 27 is a radiograph of the teeth of a wild hog, which shows very nicely the occlusion and the heavy attachment of the process around the region of the canine.

Fig. 28 presents a comparative study of the attachment of the teeth of an antelope and a horse, the figure on the left being that of an antelope whose teeth occlude with a fibrous pad on the premaxillary bone. As the result of this oc-

clusion, very little stress is brought to bear on the lower incisors. During the process of eating, the grass is caught between the lower teeth and the fibrous mat of gum, and pulled off rather than cut off. The lower incisors of the horse occluding with the incisors of the upper jaw are necessarily exposed to more wear, and the form of tooth attachment is more secure, or the alveolar process is more firmly developed in the region of the tooth to support those teeth than it is in the teeth of the antelope.

Fig. 29 shows a comparison beween the woodchuck, which is the upper picture, the mountain lion, which is the middle picture, and the antelope in the lower. The lines of calcification in all three mandibles and the manner of the development of the bone that supports the teeth are very clearly shown.

Fig. 29.

As a result of these studies, we have concluded (1) that the attachment of the tooth is closely related to the use to which the tooth is put and the amount of stress which is brought to bear upon it, (2) that the greater usage to which a tooth is subjected, the firmer will be the formation of the attachment than is found in those teeth which are very seldom used, and (3) that the tooth is supported through the fibers of the peridental membrane in the higher mammals and that the bone is developed on the opposite side to which the tooth is being forced, or, in other words, as is illustrated in the incisors of the rodent (Fig. 29), the stress on the lower incisor would displace it downward; but the heavy development of process is on the lingual side. The development of bone, shown below the lower incisor, is intended not so much as a support to the tooth as it is to form the junction or articulation between the two halves of the mandible.

A SYMPOSIUM ON DENTAL RADIOGRAPHIC TECHNIC*

By Floyd D. Leach, D.D.S., Chicago.

A FEW years ago, Dr. Hunter published in the *Lancet,* an article criticizing more or less justly the efforts of the American dentists in their attempt to restore the lost organs of mastication by the placing of crowns and bridge work in the mouths of many of the patients who came under their observation.

Dr. Hunter may have had in mind the uplift of the dental profession, for immediately upon the publication of this paper, the American dentist, being somewhat aggressive, began looking around for material in the defense of his work.

In so doing he was surprised and chagrined to find that much of Dr. Hunter's criticism was well founded, and straightway, the question of how to remedy this evil was paramount in dental circles.

The dental röntgenograph came to his assistance.

About this same time the medical profession was being placed in possession of facts concerning the relation of foci of infection to general systematic conditions, and by the wonderful research works of Drs. Billings, Rosenow, Davis and others, began to realize that the oral cavity with its complicated and delicate equipment, might be a source of infection.

So, again the need of the dental röntgenograph as an aid to diagnosis.

Previous to this time, in only those dental conditions which were more or less obscure was it thought necessary to make röntgenographs, while today many of the dentists who are trying to practice dentistry to the very best of their ability and resources are using the röntgenograph in their daily routine, the simplest cases as well as the more complicated ones being observed.

With the need of this branch of the work so apparent, every operator is called upon frequently to make röntgen examinations for dental and other lesions, and in order that his work may be above criticism, and results more uniform, a systematic procedure should be followed.

Again, the operator should have a good working knowledge of dental anatomy, histology, pathology and nomenclature, that he may be able to give an intelligent diagnosis.

First, as comprehensive a history as possible should be obtained, either from the doctor referring the case, or from the patient. A preliminary ocular and digital examination should be made which will greatly assist in the final interpretation of the results, as well as aid in placing the films during the röntgen examination.

Dr. E. J. Eisen of Milwaukee, Wisconsin (now deceased), used a system of examination which covered the case in hand so extensively that minor details did not escape notice, which might otherwise be overlooked, thus leading perhaps to some misstatement or error in diagnosis.

A chart of the mouth was used, and on this was noted, in their respective positions, all crowns, bridges, large amalgam, gold and cement fillings, also missing teeth.

*Read before the Chicago Roentgen Society, Feb. 18, 1916.

With a small Faradic battery, each tooth was tested for the life of the pulp, the result as to vitality being recorded on the chart for each particular member. Where necessary, the thermal test was made.

With this chart at hand during the interpretation of the films, the operator has brought to mind the existing conditions in the mouth, which with the history, enables him to cover the description thoroughly.

The digital examination consists in going over with the fingers, the investing tissues and alveolar process supporting the teeth on the buccal, labial and lingual surfaces, noting the inclination of roots, the condition of the floor of the mouth as to the laxity or tenseness of the tissues, and the attachment of the muscles, whether high or low.

Careful attention should be given to the hard and soft palates as to the relative size and height of the vault, and especially determining to what distal point the patient can tolerate the film without being nauseated.

In some few cases this same condition has to be taken into consideration in dealing with some of the lower posterior teeth.

These procedures may seem superfluous to some, but as we are dealing with structures (the gross anatomy of which is quite minute) and as the results are to be passed into the hands of men who are working with these tissues constantly and are more or less particular as to small details, we should endeavor to perfect our work to a point where it would be beyond their criticism. Not knowing the conditions under which we have to work in some cases, the medical and dental professions are prone to condemn rather than commend our efforts.

The position of the patient is a question which must be determined by the operator to suit his own convenience. Personally, I have used only the upright, while some will prefer the prone dorsal position.

Considering the ordinary mouth, a general survey can usually be made in ten exposures, using the Eastman 1¼x1⅝ inch films, five on the upper, and the same number on the lower arch. In some mouths is may be necessary to use 12 films, while in a few favorable cases the number can be reduced to eight by the use of 1⅝x2 inch films.

In order that the shadow of the dental structures may be of about normal size, a target film distance of from 12 to 16 inches should be used. A greater distance is unnecessary and cuts down the efficiency of the ray, while bringing the target nearer than 12 inches generally produces indistinct outlines and lack of detail of these small tissues.

Length of exposure will be variable, depending upon the efficiency of the equipment, sensitiveness of the film, density and thickness of the part to be subjected to the ray.

Using Eastman positive films, an 8 K. W. Victor Transformer on direct current, and an ordinary gas tube which will back up a 5 inch spark, the author finds that exposures of from 3 to 4 seconds will do the work in the general survey of the ordinary mouth.

The placing and holding of the film is quite a problem in many cases. Having this done by an assistant would be ideal, but we all know what the result would be if this practice were continued indefinitely. The film held by the finger

of the patient is being used almost universally for the lack of a more convenient means.

The wire holders which are manufactured by the Victor Electric Company will help solve this problem materially, as they not only hold the films firmly, but prevent its bending and distorting the shadows. They are not bulky, and the operator is enabled to see clearly where and in what plane and angle the film is being placed.

One of these holders is to be used for the molar and bicuspid regions of the upper and lower, diagonally opposite sides of the mouth, and the other is to be used for the anterior teeth in both upper and lower arches.

The question of the angle of the ray in relation to the part under observation, together with the plane in which the film is set, I dare say, accounts for the greatest percentage of failures due to distortion of the shadows. It would be safe to say that it is almost impossible to produce a röntgenogram of the teeth of the upper arch which is entirely free from distortion. This is true also of the lower anterior teeth, and especially the cuspid and first bicuspid.

In the lower molar and second bicuspid region it is comparatively easy to place the film in a plane nearly parallel to the long axes of the teeth and to direct the rays so they will penetrate at right angles to both the part and the film, producing a result which is nearly normal.

A careful study of the case in hand, and knowledge of anatomy of the parts will assist greatly in making better röntgenograms of these difficult areas, always keeping in mind that experience and perseverance are two great aids.

In making observations of the teeth of the upper arch, try to set the film so that the upper edge is in close contact with the tissues, allowing the opposite edge to stand slightly away from the crowns of the teeth, thus bringing the plane of the film nearly parallel with the teeth in their entire length. This will help materially in overcoming the elongation or foreshortening of the shadows.

The method of development and subsequent handling of the films is best determined by the operator, as most of us have our own technic well established.

When the patient cannot tolerate the film because of nausea, the parts can be swabbed with a 5 per cent solution of cocain. Two other remedies which are non-poisonous and can be easily applied are Baume Analgesique, used on a swab, or a solution of Chloretone in water used as a wash and gargle.

Sometimes by getting the patient interested in holding the film either with the finger or with the wire holder, together with breathing through the nose or holding the breath, will in a psychic way, assist in overcoming nausea.

In many instances our best efforts will be criticized severely, but not as a general rule by men who are acquainted with the conditions under which we work. This should be a stimulus and not a discouraging factor, and let us all by patient endeavor and the perfecting of our technic, try to raise the estimation of our work to as high a level as possible, and not allow it to be thought less of and degraded by those who are not willing to aid but are in the field as a purely commercial enterprise.

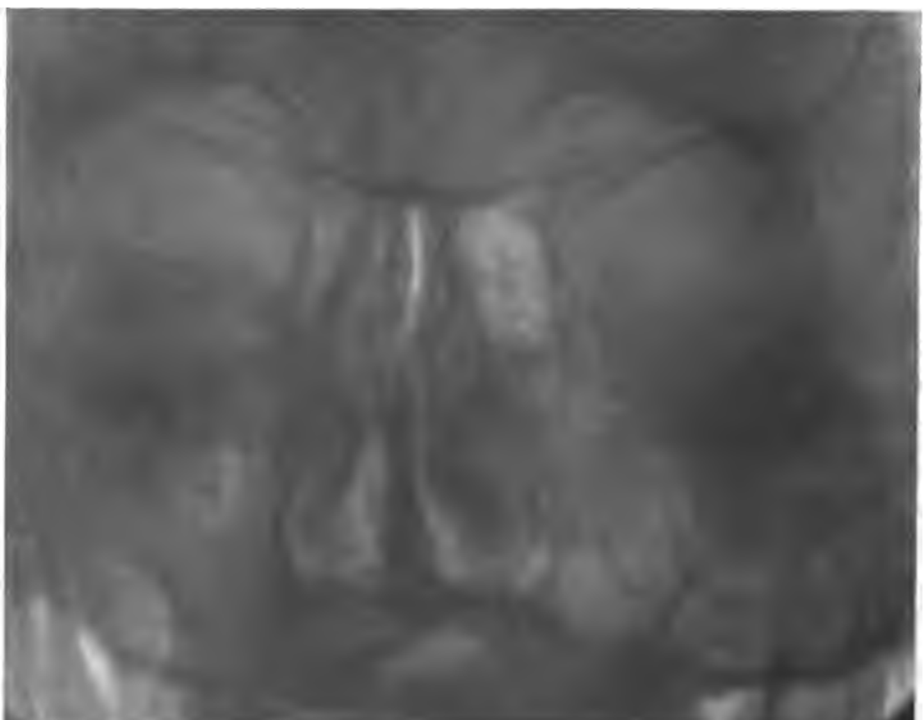
REPORT OF A CASE OF CHRONIC SUPPURATION OF THE ANTRUM—IN WHICH THE RADIOGRAPHIC EXAMINATION WAS INDISPENSABLE

By John Mackenzie Brown, M.D.

Lecturer on Rhinology and Laryngology, University of Southern California, College of Dentistry, Los Angeles.

J. E. W. Female. Aged 35. Family history negative. History of Trouble.—Sixteen years ago, following an acute rhinitis she developed an acute suppuration of the right antrum which was untreated, and merged into the chronic form. The discharge of pus from the antrum never entirely ceased at any time, but acute exacerbations occurred several times a year. Six years ago, during the course of an acute exacerbation, she consulted a dentist who advised the removal of the second bicuspid on this side for drainage purposes. This was supposedly done, and an opening into the antrum made through which the patient irrigated the cavity twice daily ever since, but with no sign of cessation of the discharge, for as soon as the irrigations were neglected for one day the discharge of pus through the nose would immediately reappear.

Examination of patient showed the absence of the second bicuspid on the upper right side in which the patient wore an obturator, and a probe passed



easily through the opening into the antrum. The nose is apparently healthy except an hypertrophy of both middle and lower turbinates of the right side. On irrigating the antrum, obtained a drahm of pus containing streptococci in predominance with staphylococci and pneumococci. Transillumination shows a very dark antrum. The patient was referred to a radiographer who made the radiograph here illustrated, and shows the presence of a foreign body much like a tooth apparently in the antrum under the superior wall. A Caldwell Luc operation was performed, and a foreign body located as shown by the radiograph, and removed; which proved to be the root of the second bicuspid which was supposedly extracted six years ago. The tooth had broken off and the dentist in his efforts to extract the root had driven it up into the antrum. The bone on the superior wall of the antrum was denuded for a space of about the size of a quarter of a dollar. Why the root had remained in the top of the cavity I presume was due to the patient taking the reclining position after the extraction. and the root lodged at the top and set up an inflammatory condition encapsulating it.

Three weeks after this operation. I am unable to find any discharge from the antrum.

X-RAY PLATES MAY BE SHOWN TO JURIES

THE Supreme Court of North Carolina, in affirming a judgment in favor of the plaintiff for damages for personal injuries alleged to have been caused by having a heavy truck pass over one of his feet, holds that there was no error in permitting a physician who had made skiographs of the plaintiff's feet to exhibit the plates to the jury. It was true that the witness who made the skiographs did not say in so many words that the photograph was an accurate and true representation of the condition of the foot, but this was a reasonable inference from his evidence.

This decision is of interest to members of the dental profession, and is but one of the many future developments in dentistry resulting from the use of the x-ray. Under the circumstances where there is any uncertainty about the treatment, a skiograph is essential both from the patient's and operator's standpoint. Some writers would have us believe that the x-ray is nothing but a "shadow of doubt." However, when the dental skiograph is introduced to a jury it becomes a decided reality, and while it may be a "shadow picture," it will, we venture to think, be considered by the jury as a most important piece of evidence.—*Oral Health.*

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EDITORIALS

The New President of the American Medical Association

DR. CHARLES H. MAYO, of Rochester, Minn., was elected President of the American Medical Association at its annual meeting in Detroit, June 12-16.

Dr. Mayo needs no introduction to the dental profession. His fame as a surgeon, and the reputation of the Mayo Clinic, of which he is the junior member, is known to every physician and dentist, not only in this country but throughout Europe as well.

It was Dr. Mayo who said a few years ago that the next great step in medical advancement would come from the dental profession. His unerring judgment in this prediction is borne out by present development in dental science.

Dr. Mayo was born in Rochester, Minn., July 19th, 1865, the son of the late Dr. William Worrall Mayo, and Louise Abigail Wright Mayo. He graduated from the Chicago Medical College in 1888, and at once began practice in Rochester with his father and his elder brother, Dr. William J. Mayo, who was president of the American Medical Association in 1906.

Dr. Mayo has frequently been honored by his confrérés. In 1904 he was president of the Western Surgical Association; in 1905, president of the Minnesota State Medical Association; chairman of the Section on Surgery of the American Medical Association in 1907; and president of the American Congress of Clinical Surgery in 1915.

Dr. Mayo bears the honors heaped upon him in a manner that is in keeping with his worth as a surgeon and a scientist. With quiet demeanor, and a singleness of purpose, he pursues the even tenor of his way, intent upon one thing—more light on surgical subjects—more ability to serve. His life and achievement is a striking example of the adage that there are exceptions to all rules, because it is said that "a prophet is not without honor save in his own country." He was born in Rochester—in Rochester he has achieved his greatest success—in Rochester he is best known, most honored, and by its citizens he is most loved.

The dental profession can, with absolute assurance, count upon Dr. Mayo's help when this is needed and sought.

State Dental Journals

ONE of the most auspicious signs of dental advancement is the establishment of independent state dental journals. It marks a distinct epoch in dentistry and is sure to mean much to this science. A state dental organization can accomplish much more when it has an independent medium through which to wage its battles for reform and for betterment within its ranks, than where it is forced to depend upon a journal that is subsidized by manufacturers and dental supply houses.

Independence in thought is the life blood to scientific development. Organizations whose purpose is scientific development must let the people whom they are trying to serve know what they are doing, and they must let what they are doing be known in no uncertain manner. This can only be accomplished through the medium of the press. State dental organizations are sponsors for the profession in their respective states, and a profession can rise no higher than its organization.

A journal owned and controlled by the state organization with a vigorous policy for betterment and higher development, will do more to unfetter dentistry and to place it where it rightly belongs among the sciences, than any other influence, save possibly that of taking dental education out of private hands and putting it under the control of universities.

A national journal for any national scientific body is of untold benefit to that body, and indirectly to the people whom that body serves. For a national journal to rise to its greatest heights and render its greatest service, it should be backed up and assisted in its work by state journals. Universities for advanced teaching must be fed by high schools and colleges; Field Marshals, Major Generals and Lieutenants must have Captains and Corporals over the privates in the ranks if the effectiveness of military life is attained.

It is only by comparison that change is noticeable. Ten or twelve years ago there was scarcely a state medical journal in existence—today every state medical society has its own journal, and they work hand in hand with the national organ

of the American Medical Association. Contrast the medical profession in America today with what it was ten or twelve years ago. Compare the status of medical education today with what it was at that time. Who can forget the privately owned medical school of years gone by, grinding out half-baked, unfit pseudophysicians to prey upon a credulous people; who but remember the hundreds of privately owned medical journals that flourished in the long ago for the sole purpose of making some patent medicine manufacturer rich and powerful from his ill gotten gains? There is not one among us today familiar with the evolution of medical education in this country who will say that the state journal has not played a prominent part in bringing about the change, or who would go back to the old order of things medically.

Dentistry has made great strides in America during the last decade, and it is safe to predict that before another ten years have passed, state journals, owned and controlled by the State society, will be the rule rather than the exception. Then dentistry will have a battery of machine guns to back up its heavy artillery. It will have efficient and effective mediums to wage war on the unfit, both within and without its ranks.

You will ask, "how will State journals be supported?" Turn again to the past and you will get your answer. The same problem was met and solved by State medical societies. Your dental dues can be raised so that they will cover all this expense, augmented by clean, ethical advertising.

Right always finds the way. State dental journals are in line with correct dental development in America. Their establishment will be the next forward movement of this science.

The Dental Exhibit at the American Medical Association Convention

VISITORS at the scientific exhibit of the Detroit meeting of the American Medical Association, June 12th to 16th, were interested in, and much benefited through the exhibit made by the Research Committee of the National Dental Association.

It is safe to say that the visitors who thronged this exhibit will never forget the impression made upon them by this display of mouth infection and the role such conditions plays in disease.

Aside from the benefit the public derived from this, another great object was attained, the narrowing of the gulf between the medical and dental professions. Science knows no boundaries, especially when the object of the science is to benefit humanity by the elimination of diseases and its train of suffering. Dentistry is truly the hand maiden to medicine. The signs of the times point to more harmony and a closer union between these professions. In a few more years, men like Price, Vaughan, Hartzell, Mayo, and Morehead will eliminate the last remaining lines of demarcation between dentistry and medicine.

An intermingling of these sciences similar to that at Detroit, is a long step in the right direction.

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ORIGINAL ARTICLES

A NEW METHOD FOR THE RELIEF OF LATERAL TENSION IN CLEFT PALATE OPERATION*

BY M. N. FEDERSPIEL, B.Sc., D.D.S., M.D.

Professor of Oral Surgery, Dental School of Marquette University, Milwaukee, Wisconsin.

IN order to have the reader fully appreciate my method for the relief of lateral tension in cleft palate operations it will be convenient to describe the technic of combined uranoplasty and staphylorraphy.

While much has been said and done in the surgical correction of these defects, the method universally employed is that known as Langenbeck's. The Langenbeck operation is accomplished by dissection of muco-periosteal flaps obtained from either side of the cleft, and sutured in the middle line. Although called after the great German surgeon, and rightly so, inasmuch as he first clearly enunciated the principles underlying the operation, it is certain that similar plans had been previously employed by others.

Operations upon the soft palate were undertaken much earlier than upon the hard. As far back as 1760 a dentist named Lemonnier united the borders of a cleft in a child. Desault and others record similar cases in the first decade of this century.

M. Krimer seems to be the first who attempted operative treatment on the hard palate (1824). Dieffenbach, Warren, M. Beanfils, Avery Graefe, M. Ronx, and a number of others, attempted surgical correction of palatal defects in the early part of the eighteenth century followed by Dieffenbach, Mason, Polloch, and a number of surgeons abroad and in this country.

The Langenbeck operation consists of the following steps:

1st. Freeing of muco-periosteal flaps.

2nd. Freshening the edges of the cleft.

3rd. Placing and tying of sutures.

4th. Relief of lateral tension.

*Read before the Kansas City Dental Society, Kansas City, Mo., February, 1916.

FREEING OF THE MUCO-PERIOSTEAL FLAPS.

This procedure is accomplished by cutting the mucous membrane along the entire borders of the cleft and separating the soft tissue by periosteal elevators and cutting the tissue loose from the distal surface of the horizontal plates of the

Fig. 1.—Showing lead plates with wire ligatures cutting through the soft tissues.

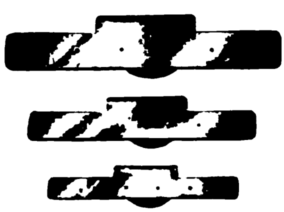

Fig. 2.—Type A. Author's tension plates.

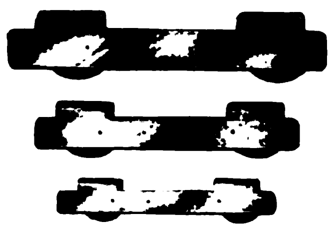

Fig. 3.—Type B. Author's tension plates.

palate bone. This should be done with great care in order to prevent tearing or lacerating, which may seriously impair nutrition. Naturally this brings on considerable hemorrhage which can be stopped by firmly pressing a sponge gauze against the bleeding surface. It is not always possible to avoid wounding the anterior palatine and especially the posterior palatine artery. Should one of the vessels be nicked it will cause severe and prolonged hemorrhage. It is therefore better to completely divide the vessel so that it will contract at its ends, thereby overcoming protracted bleeding.

FRESHENING THE EDGES OF THE CLEFT.

This can best be accomplished by grasping the uvula on one side with a catch forcep and putting tension on the soft tissues, then with a very sharp thin-bladed knife cut a thin marginal strip along the entire flap from the uvula to the apex of

Fig. 4.

Fig. 5.

the cleft. This same procedure is to be carried out on the opposite side. The freshened surface should be cut square with the flap tissue. A beveled surface is conducive to inviting failure. If the raw surfaces are cut square, it is an easy matter to bring them together in close apposition which will enable rapid union during the healing period. In cases where there seems to be a shortage of tissue in the soft palate I prefer to split the border of the velum about one-eight of an inch and then unite the raw surfaces.

PLACING AND TYING OF SUTURES.

Various kind of suture material has been adopted for holding the pared edges together, such as silk, horse-hair, linen, catgut, wire, etc. Personally I do not be-

Fig. 6.

lieve that the difference in value of the above named suture-material is of any great consequence, providing the operator does not depend upon the same to overcome lateral tension. Sir William Ferguson, in 1844, recognized that the tension on the ligatures frequently invited failure, either through their cutting out or by shutting off the circulation, thereby bringing on starvation necrosis and infection. To overcome this tension Ferguson divided the levator palati, the palatoglossi, and the palato-pharyngeal muscles. In 1860 Dr. Agnew believed that the tensor palati muscles were responsible by pulling the newly approximated surfaces on the soft palate apart, thus causing the sutures to pull out. Therefore he advocated making an incision close to the hamular process of the sphenoid bone, and in this way overcoming tension. For a long time these methods were extensively adopted by operators in this and foreign countries. The end results were not satisfactory. This was pointed out in a paper by Dr. T. W. Brophy in 1901 in

which he says, "The formation of cicatrices following incision renders the soft palate thick and unyielding, so that its function is performed imperfectly." Dr. Brophy finds it unnecessary to cut the muscles on either side, it was he who introduced the application of lead plates. The advantages claimed for these plates are to render the palate inflexible and the prevention of the cutting out of the

Fig. 7.

Fig. 8.

Fig. 9.

sutures. Dr. Blair reports that he has discontinued the use of lead plates as a retention device because they occasionally caused sloughing, in spite of every care; he depends entirely upon the sufficient freeing of the flaps. In my experiences I have never found that the plates cause sloughing, but that they did not

prevent the cutting out of the sutures. (See Fig. 1.) They are, however, of a distinct advantage in rendering the palate inflexible. In order to prevent the cutting of the suture through the soft tissue I have devised a new tension plate which will prevent the suture material from cutting out and at the same time relieve the tension as well as render the palatal tissues inflexible. These plates are made from noncorrosive metal B. I. B. American gauge 22, in various sizes and types. (See Figs. 2 and 3.)

The object of these plates is to prevent the cutting out of the wire ligature which frequently happens with the Brophy plates. In order to fit these plates it is necessary to make a small incision near the gingival border of the last molar, being careful not to cut the palatine artery. (The operator must take into consideration the degree of the cleft, the position of the blood vessels and the type of plate that best suits his purpose.) The incision should be of sufficient length to permit the flange of the plate to enter and lie between the palatal bone and soft tissue. Previous to fitting these plates it is necessary to pass silver wire (American gauge 24) through the muco-periosteal flaps and then through the holes in the plates. The ends of the wire are then passed through perforated lead shot and made tense by pulling the wire and crushing the shot after the borders of the flaps can be approximated without tension. After this is done I denude the border of the cleft and then place and tie the coaptating sutures after the McCurdy method.

Fig 10.

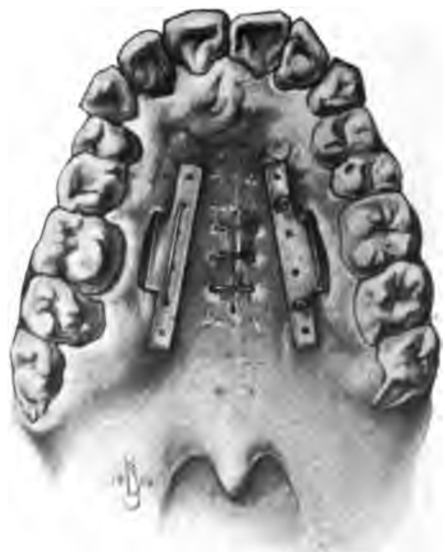

Fig. 11.

While to the beginner it is rather a difficult procedure to properly fit these plates he can, with a little patience, soon master the technic of this simple procedure as an aid in obtaining uniform anatomical, as well as physiological results.

Fig. 4 illustrates the cleft of the hard and soft palate. Fig. 5 shows the same case with the plates in position. Fig. 6 shows the same case and the operation

completed. These plates are now relieving the center ligatures so that healing can take place without tension.

Fig. 7 shows an extensive cleft of the hard and soft palate. This patient, for years, had been wearing an obturator. Fig. 8 shows the same case with the palatal opening closed and held so with type B tension plates. Healing took place rapidly in this case and the patient was discharged ten days after the operation.

Fig. 9 illustrates the so-called "button-hole" opening in the center of the palate. This form of opening usually is the end result of an attempt to close the hard and soft palate. Figs. 10 and 11 show the advantage of using the author's type A tension plates for closing the opening shown in Fig. 9.

THE EVOLUTION OF THE PRINCIPLES OF JACKSON APPLIANCES

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PART IV.

Removable Jackson Appliances

THE principles to be pursued in designing lower Jackson appliances are similar to those for upper appliances.

The posterior, side arm anchorages are to be made in the same manner, also all "finger" extensions are to be governed by the same various selective designs for the given conditions at hand. The body wires for lower appliances cannot vary under different conditions, however, because of the limited position which they occupy between the inner surfaces of the mandible and the tongue.

After the side arm anchorages are completed, the first step in lower body wire bending, is to bend the wire into a U shape to fit closely around the lingual curve of the anterior segment of the arch with the ends pointing distally. In placing the anterior portion of this heavy wire, it must be so arranged that the ends may be bent back upon themselves from points in the region of the distal most teeth engaged in the anchorage, running parallel with the lower portion forward, and terminating about midway of the anterior most teeth engaged with spring clasps.

If a straight loop is placed low enough in the sub-lingual region, it will interfere with the motions of the frenum linguæ, which will cut into it in a very painful and damaging manner.

If a straight loop is placed higher than this region, it is very difficult to bend the ends forward, and keep the upper portions low enough to solder along the lingual surfaces of the posterior teeth without touching the lower portion of the wire which it parallels. This renders it very difficult to keep solder from running between the wires and the adjustment is made more difficult in tightening, if the wires are very close together.

In order to compensate between these conditions it is necessary to bend the

anterior end of the wire upward (Fig. 31). The best method for making this bend is to first bend the correct size and shape around the sub-lingual regions, then by grasping the desired amount of the anterior portion between the jaws of the heavy parallel pliers, the bend can be made, retaining uniformly horizontal relations between the ends which point posteriorly (Fig. 32).

That portion which is bent upward can be placed along the most prominent part of the ridge below the gum margins of the anterior teeth, allowing the ends to run backward at positions low enough for the looped parallel ends to fold back and rest no higher than the gingival borders of the posterior teeth, with about one-eighth of an inch between them, thus reducing the bulk, permitting of thin beveled finish, and not interfering with the tongue or pressing against the soft tissues (Fig. 33). This final bend should be made around the nose of round-nosed pliers.

Fig. 31.

Fig. 32.

Fig. 34 illustrates the completed lower body wire suspended in mouldine, slightly away from all soft tissues. Note that the anterior portion rests higher than the frenum linguæ can reach, but at the same time low enough not to interfere with "finger" extensions adjusted to the lingual surfaces of the anterior teeth. The body wire should be "tacked" to position with a very small amount of solder at both posterior ends, leaving ample space between the arms and the upper loops of the wire to form a groove into which to solder the attachment ends of finger springs.

Fig. 35 illustrates the completed appliance for this case. It will be noted that the continuity of this arch has been broken, shown at present by the absence of the left first bicuspid. The normal diameter of this arch is reduced the amount of the mesio-distal width of this missing tooth. Under this condition, the history of the case may reveal the early loss of the deciduous molar with the resultant migration of the approximating teeth, causing the impaction of the bicuspid. A radiograph would prove either this or the absence of the bicuspid by atrophy or traumatism.

Under the above clinical conditions the other parts of this arch have developed under normal conditions.

The environment of the teeth under the influences of the tongue lingually, the buccal and labial muscles and the occlusal stresses have reduced the size of this arch in certain segments which are normal and regular, insofar as the relations between the teeth in these segments are concerned.

If this missing tooth has been extracted to merely correct a buccally erupted cuspid, the same conditions exist from the corrective standpoint on a basis of normal occlusion.

This is a case of neutroclusion, the left molars and the second bicuspid having formed lingually, but have not moved mesially. The anterior teeth have moved lingually, proportionately greater at the left cuspid. The left molars and second

Fig. 33.

Fig. 34.

Fig. 35.

bicuspid are in correct relations in one segment, the anterior teeth are in correct relations in the second segment, the right posterior teeth are in correct relation in the third segment. The three teeth comprising the left segment are engaged with one full spring clasp on the first molar, with two partial spring clasps on the proximating teeth soldered together on the buccal sides.

There is more constriction on the left side than on the right side, indicating the need of a greater resistance for less expansion on the right side, therefore, the four posterior teeth are engaged on the right side with partial plates on the lingual surfaces, the first bicuspid bearing a spring clasp, but owing to the fact that

the right second molar is not fully erupted, the spring clasp is placed on the first molar. The right cuspid rests at the *rotary center* around which the anterior teeth have moved lingually.

A finger spring is adapted to the curve of the lingual surfaces, soldered into the right arm of the appliance, terminating at the other end in the form of a hook looped around the disto-proximal side of the left cuspid. These anterior teeth may be banded for lugs to be soldered to the lingual surfaces for this finger to snap beneath or a second lingual finger may be adjusted to rest above this lower one for the purpose of holding it securely down to position under active pressure. When this lower spring is rendered active by bending it forward from the right side, each anterior tooth is moved in a different arch toward its normal position.

The finger affords the left cuspid a longer radius through which it moves forward and outward toward a straight line across the arch opposite the right cuspid, to its correct position of angular prominence in the parabolic curve of the normal arch.

The left lateral responds to the path of force applied on a shorter radius than the cuspid, the left central less than the left lateral, the right central less than the

Fig. 36.

Fig. 37.

left central, the right lateral less than the right central, the right cuspid is only slightly turned; in this way the fingers may be so controlled as to guide each tooth in a segment along entirely individual paths of movement toward their normal positions.

By using the posterior loops of the body wire as rotary centers, a uniformly diffused expansion is applied across the bicuspids and molars. If positive molar expansion is required, the middle of the anterior curve of the body wire is bent open as a rotary center.

In this way individual tooth movement can always be perfectly controlled, under a type of active anchorage, which renders it impossible for unexpected secondary forces to cause warpage of arches or depression, elongation and other displacements of any serious nature.

The Jackson method possesses features of great value for the correction of irregularities of the temporary teeth. The correction of such irregularities usually involves development across the posterior sides with subsequent anterior alignment.

The gingival constrictions of temporary teeth do not always afford favorable undercuts for the spring clasp attachments for simple removable appliances. In

this event, the fixed-removable attachments are better indicated. Even with this method, the technic of fitting simple bands to the anterior and posterior anchor teeth on both sides can be very easily and effectually accomplished in the mouths of children between the ages of five to seven years, after which the bands are removed in a plaster impression and the appliance finished out of the mouth.

In the correction of irregularities during those intermediate years between the loss of the temporary teeth and the eruption of the permanent teeth, the Jackson method is invaluable.

There can be no greater service performed in orthodontia, than the correction of the first appearances of irregularity between the ages of seven to twelve, for by overcoming these original complications, restoring to Nature the normal schedule of development of the arches and eruption of the teeth, the preventative value of such work well done is invaluable.

Fig. 36 illustrates a lower arch with irregularity caused by the early loss of temporary incisors, causing the posterior sides to lose their stimulus or lateral development through the influence of the normal eruption of the permanent incisors. Through this means the permanent laterals are excluded from the arch

Fig. 38.

Fig. 39.

and will be forced to erupt in interlocked positions, if the present conditions remain.

This removable Jackson apparatus contains full spring clasps for the second premolars, with partial clasps on the first premolars soldered to the full spring clasps on the buccal sides. The body wire is made of a 13-gauge wire. Small hook-shaped extensions engage the cuspids.

In these two side arms exists a uniform degree of resistance, so that by the very mild, but constant, stimulus of the spring force of the body wire, these sides can be developed laterally, restoring the normal width and concentrating the space gained for the normal eruption of the laterals. If the centrals are spaced, new "fingers" may be added at any time with which to draw them together.

Fig. 37 illustrates the condition formed in an upper arch, origin of irregularity, traumatic injuries causing premature loss of temporary incisors. With this anchorage the fingers may be changed any number of times to meet advanced stages of the work, as each complication is overcome.

Fig. 38 illustrates an anchorage engaging the six year molars with anterior

portion of the appliance designed for the lateral development of the arch, so as to diffuse the space thus gained through the anterior segment of the arch. After the lateral development is accomplished the anterior extensions may be replaced with "fingers" to perfectly align the incisors and in this progressive manner the appliance can never be too complicated to be unnecessarily bulky for the different parts to interfere with the work of others.

Another great advantage in the use of the Jackson method in cases of this age, as in all others, is the ease with which the appliance can be altered to meet the enlarging dimensions of the growing arch, whereas, in all "fixed" apparatus the appliance is very complicated, or in resting at the objective point when first inserted, it stands out from the teeth, cutting the lips and cheeks or it becomes too small before the desired results are accomplished.

Fig. 39 illustrates an arch wherein the centrals were interlapped from severe lateral constriction of the arch. The appliance was originally designed with hooked springs engaging the mesial surfaces of the centrals so as to concentrate the space gained in development between the centrals. Later those extensions were substituted for the labial alignment bow with lingual fingers to attend to the final details of perfectly aligning the incisors.

If trouble is encountered by children less than twelve years of age in the removing appliances, the fixed-removable anchorage should be used. Trouble of this nature is entirely the fault of the operator, however, and is either the result of failure to properly impress the parents with the value of the work, so that they become negligent or by poorly constructed or poorly fitted appliances, the discomfort is too great to tolerate, whereas in fixed appliances, under the same conditions of the operator's carelessness, the patient is helplessly forced to bear.

RETENTION

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PART I.

THE practice of orthodontia presents many complex problems, but none more complicated, or, I think, less appreciated and less understood than those of retention. I believe that there are no hours spent upon a case, of which the patient's future good so imperatively demands unerring judgment as those hours given to the consideration and application of the retention. *This consideration and planning of retention must begin before the arches are set for the active treatment,* that no unnecessary tooth-movement shall occur which may preclude the use of the most simple retaining appliances possible for the case. To my mind, the supreme height of orthodontic futility is to carry through carefully the active correction of a case, and then apply an insufficient and illy conceived retention in the sublime faith or wild hope that somehow fortune will incline to the side of the

operator, and may be it will come out all right. If the philosophy of cause and effect has a relentless application to any one science or art more than another, it almost seems to me that orthodontia is the object of its most unremitting attention. No tooth ever stayed in any particular position except by virtue of the fact that the balance of all the forces bearing upon it held it at precisely that point.

It is the almost uniform experience of beginners, and the all too frequent misfortune of many practitioners of experience that active treatment may be carried through with apparent success, the case retained for a period of time which seems in all reason sufficient, and yet, after retention is removed the correction is in large part lost in the succeeding few months or few years, and the original malocclusion is ultimately replaced by another of uncertain degree, perhaps less, perhaps greater than the original.

To many the idea of retention has been that if a reconstructed, or more properly speaking, realigned arch is held for a period of time more or less closely approximating twice the time required to align it, or the period of active treatment, that the retaining appliances may then be removed and the teeth of the realigned arch will remain in their new positions by virtue of having been held there until they have grown firm. This theory has been responsible for endless heartaches, disappointments, and discouragements. No conception of retention could be more erroneous. If the realigned members persist in their new relations after treatment in accordance with this theory, it is the result of merest good fortune, and not because of intelligent plan or adequate conception of the difficulties involved or the conditions to be met.

It will be obvious that every full dentured malocclusion that presents is a mechanically balanced structure. The result of this mechanical balance being an anatomical abnormality in no way argues against its existence. The responsible factors are abnormal forces governing the placing of the teeth in the jaws as they erupt, and the relation of the jaws and arches as units, to each other. These forces we call "Forces of Occlusion." They, in turn are dependent upon normal development and freedom from pathologic conditions of related facial and cranial structures, as well as upon normal general metabolic activity of the individual. So, in permanently correcting a malocclusion, we proceed by correcting an ultimate effect, or result, of an abnormal primary cause, and then depend upon nature's constant effort toward harmony that through the perpetuation of this corrected effect by mechanical means, that subsequent development will proceed in the direction of the anatomical normal, and balance be again so established that the "forces of occlusion," shall ultimately become normal in direction and degree. In other words, the object of retention is to reestablish balance in the facial structure which has been thrown entirely out of balance by the change accomplished in active treatment. It is accomplished by supporting the teeth in their new relations, which are to be the basis and guide in the development of the more remote as well as the immediately adjacent hard and soft tissues. This development will occur as the result of nature's effort to restore balance, symmetry, and harmony. In this unbalanced facial anatomy which we have at the conclusion of active treatment, the factor which is farthest out of balance is the dental arch, by reason of the relatively rapid and large development caused by mechanical stimulation. So the retaining appliances are merely the agents employed to perpetuate the most

prominently inharmonious factor of the facial anatomy existing at the completion of active treatment, the dental arch, until such time as the other parts of the facial structure develop proportionately to it and a harmoniously normal structure shall result.

There is a wide range in the time required to accomplish this balance. It will depend upon the amount of development necessary to restore, or produce, such harmony, and the rate of metabolic activity present in the individual case. This necessary amount of development will in turn depend upon the degree of original variation from normal balance. The rate of metabolic activity will be conditioned upon whether it is occurring during the period of normal growth or after this period is past, and the perfection of the general health and condition of nourishment of the individual. A most happy result may be possible of completion in the occasional case which comes to us with the patient in good physical condition and growing rapidly, with the bicuspids and cuspids almost ready to erupt, and seemingly at almost the same time, though a considerable degree of expansion be necessary and perhaps some incisor rotations. On the other hand, for the mature adult case we cannot even guess upon a time limit, but can only hold on for several years and then releasing them little by little, note the effect and govern ourselves accordingly, replacing parts if necessary, or revising the original retention as seems indicated to afford support, or rather restraint as the balancing process proceeds.

The general health and the rate of metabolic activity will be profoundly affected by the degree of perfection of normal breathing which the patient enjoys, and consequently nose and throat conditions must receive such attention as will insure entire freedom of the air passages from obstruction.

It is obvious that every case is in a large measure, a law unto itself, and that no rule can be evolved so comprehensive, or so perfect, that it can be arbitrarily applied to any considerable proportion of all cases treated, for no two are so alike that they have not very distinctive features of variance from each other.

(To be continued.)

THE HISTORY OF ORTHODONTIA

By Bernhard Wolf Weinberger, D.D.S., New York City.

(Continued from page 450.)

G. *CARABELLI* (1842-44). Among the numerous publications pertaining to dentistry brought out in the early forties was the important work of Carabelli—*"Systemateache Handbuch der Zahnheilkunde."* An attempt to classify the various forms of occlusion of the teeth had now and then been made, with, however, varying results. Carabelli enumerated and described six forms, all pertaining to bite, or "mordex."

1. Mordex normalis, or normal bite.
2. Mordex rectus, or edge-to-edge bite.
3. Mordex apertus, or open bite.

4. Mordex prorsus, or protruding bite.
5. Mordex retrorsus, or retruding bite.
6. Mordex tortuosus, or cross bite.

Under the fourth group, we find the protruding jaw defined, i.e., protrusion of the upper or the lower jaw. This classification was undoubtedly a step in advance, yet it did not meet with the approval of his contemporaries, as we do not find it adopted in their works.

Carabelli devised numerous appliances to correct irregularities of the teeth, and recommended that they be imitated and made use of. His method consisted of a flat band (arch) of gold, extending from molar to molar, the ends of which were curved, so as to encircle the molars, and act as clasps. Attached to the flat metal were two ivory blocks, similar to that of Fox.

By drawing and by pushing the teeth Carabelli succeeded in obtaining the desired results. To accomplish the first object he used silk ligatures or metal wire. The appliance devised by Carabelli was probably as novel and original as complicated. Attached to the anterior surface of the flat band wire were a series of screws. Strings were wound around the teeth to be regulated, and then around a horizontal bar. This bar was free from the band (arch) wire and passed through two upright pieces of metal. Attached to this bar was a rachet. Between the rachet and the arch metal proper were wire springs. A watch key was used in order to rotate this bar. Another appliance for pushing the teeth to their desired position, was similar to the one of Schange's. They consisted of a piece of metal soldered to a screw. The other end of the screw passed through another piece of metal, which was attached to the arch wire by two upright bars. By means of a watch key the screw was tightened, forcing the malposed tooth into position.

Desirabode (1843), in his *"Nouveaux éléments de la science et de l'art du dentiste,"* published in 1843, described several inventions that had an important bearing on our work. He was the first to attempt giving this specialty a name and in his article *"Gazette des hopitaux"* (1839) appears the first mention of this particular branch as "Dental Orthopedia."

In his book he has divided the subject into two heads: (1) Dental Hygiene and (2) Facial Orthopedia. Under Dental Hygiene he gives the following:

"We have hitherto been occupied with the anatomical and physiological facts which constitute the science of the surgeon-dentist. But here commences his real art; for we are about to describe, under the name of dental hygiene, a methodical exposition of all the cares and precautions which are intended to facilitate the development of either dentition, or to preserve the teeth in a constant state of health and cleanliness. We will append to this chapter, under the name of orthopedia, and in accordance with the true acceptation of the word, now much used and well understood, a series of means which, although requiring the application of the hand, cannot, nevertheless, be properly considered as operative surgery, inasmuch as they address themselves to conditions which, properly speaking, are not diseases. Such are the straightening, shortening and separating of the teeth; matters with regard to all of which we are about to announce precepts which are rational and of easy application."

Section 1.—Of the Means of Directing the Eruption of the Teeth, and Facilitating their Arrangement.

Direct Means to Prevent Errors of Second Dentition.—"We again see that there are pathological phenomena which signalize the replacement of the teeth, as well as those which appear at the epoch of their first eruption; to prevent these

Fig. 1.—G. Carabelli, 1842.

Fig. 2.—Appliance devised by Carabelli.

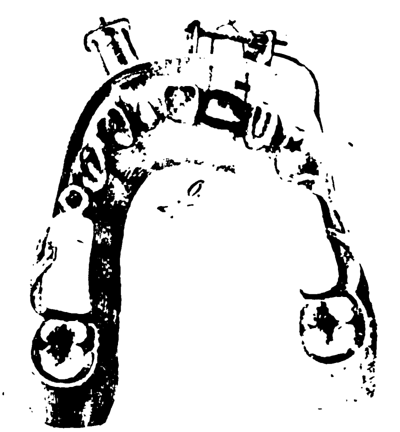

Fig. 3.—Same as Fig. 2 applied to the model.

accidents and apply to them suitable treatment under all circumstances, belong properly to general medicine. But the symmetrical arrangement of the teeth is especially the work of the dentist. What, then, are the means proper to favor this arrangement? Is it necessary, as some ancient authors, and many modern ones, have pretended, to take out early the primitive teeth, or rather to seek to preserve them until they naturally fall out?"

"It is difficult to establish, in this respect, a precept rigorously applicable to all cases. We may, nevertheless, say, in general terms, that unless it is evident that the primitive tooth is an obstacle to the appearance of that which should replace it, the extraction is, to say the least, useless. It is to extend the sphere of our operations, but not to respect physiological functions. But in the case, on the contrary, where the tooth is a mechanical cause, hindering the permanent one from developing itself properly, or to place itself in its proper position, there is an absolute necessity to remove it; for by delay we expose the child to irregularity of denture, a deformity easier to prevent than to cure."

"This operation has for a long time been opposed by the fear of removing with the milk tooth the germ of that of replacement; but this fear can now have no influence, except for practitioners who do not know that from the age of four and a half to five years this germ is entirely ossified, and no longer touches the primitive tooth, whose root begins to disappear."

Under Orthopedia he has attempted to classify the subject according to the position the teeth assumed, and the causes of these positions.

"Orthopedia. Of the Means of Remedying Irregularities of Dentition—Vices of Conformation Dependent Upon the Teeth."

"In describing, with all necessary minuteness, the care necessary for the preservation of the teeth, we have admitted that they were regularly arranged; but, whatever care we take to favor this arrangement, it happens but too frequently that they persist in taking a wrong direction. Our art is not helpless under such circumstances; it is only necessary to be well persuaded that the success of our means will depend much upon the circumstances under which they are employed. As to the nature of these means, they are far from being, as some recent writing would inculcate, modern discoveries. There is not a dentist who has practiced for thirty years, who has not employed, every day, the very means now in use, and if some practicians seem to make this a subject of particular attention, this is rather the result of enlightened public opinion, which better appreciate these things, than of anything they have added to former knowledge."

"The irregularity of the teeth depends either upon their deviation, their formation or implantation. Each of these vices may be carried to the extent of true deformity. Let us first examine the vices of deviation."

"These irregularities are commonly known as obliquities. The obliquity may be forward, backward, laterally, or by rotation, according as the teeth which constitute it are directed outward or inward, mount upon the faces of their neighbors, or have undergone such a movement that one of their sides presents forward, and another posteriorly."

"The primitive or temporary teeth rarely exhibit these deviations, and when they exist, they are generally so little important as to be unworthy of attention.

As to the secondary teeth, the incisors and canines are most frequently thrown out of their proper place, which is readily enough explained by the fact that their roots are single, and occupying less space in the alveolar border than their crown does beyond it, they are more exposed to forces which may be brought to bear upon them."

"It must not be supposed that any great force is necessary for this purpose; it only requires a slight default of antagonism between two powers in the midst of which the teeth are placed, that is to say, between the lips in the front and the tongue behind. Do we not perceive that, in almost all cases of hare-lip, the teeth corresponding to the fissure, throw themselves forward; and that the operation which causes this deformity also replaces the teeth? This is an important fact, which goes far to enlighten us upon the choice of means proper for replacement."

"If we study the causes which produce these deviations, we find it sometimes in an organic malady of the alveolar border; but the more common cause, as we have already said, is the defect of relation between the size of the teeth and the space they ought to occupy; the tardy shedding of some primitive tooth, the presence the tooth trespassing upon the space proper to another finally, the existence of a supernumerary tooth, which we have called a surplus tooth."

"Art has two kinds of means of remedying obliquity; the first acts slowly, continuously, and are incapable of occasioning the least accident or even the slightest pain; the other, on the contrary, acts promptly but painfully, whence they would be abandoned, even if there were not other peculiar inconveniences attending them."

"The first of these expedients consists in bringing back the distorted tooth into its proper place, by the aid of traction exercised upon it by ligatures, which have their point d'appui upon the neighboring teeth; but two conditions are necessary: there must be sufficient space to receive the tooth, and the tooth which forms the basis of support to the traction must be more firmly fixed than the one to be removed."

"As many persons doubt the success of this proceeding, it is proper to observe, that the tooth to be removed does not represent an inert force to be overcome, but an active force, the direction of which should be changed. Let us reflect upon the facility with which the most firmly resisting of our tissues yield to the action of slight forces when long continued; and we will perceive that there are few cases in which a simple lever, skillfully used and firmly fixed, will not suffice, especially in young subjects, to replace a tooth, however distorted it may be. Everything depends, with these cases, upon the address and judgment of the operator."

"But should we have threads alone, reckoning upon their own elasticity, or only use them as means of attachment? We believe that threads have rarely the power supposed, and experience shows that they are fraught with great inconvenience. In the first place, they loosen the teeth around which they are thrown for support and again, they strip these as well as those to be removed, and act on the tooth too near the neck."

"We know that, to obviate the loosening of the supporting teeth, those are chosen which have stronger roots than the irregular teeth; and that to prevent

the ligature from gliding under the gums, use is made of a small hook, one of the curves of which fits upon the cutting edge of the tooth, while the other holds back the ligature. But, on the one hand, the form of the roots is too variable to permit us always to calculate upon their respective forces, and if on the other hand, the hooks applied which always impede the action of these last, and hinder it from being direct."

"Thus, then, if we would act with certainty, we ought rarely to confine ourselves simply to ligatures. There being a certain resistance to overcome, as must be the case in patients somewhat advanced in age, we may augment the power of the ligatures by combining their action with those of different apparatus, commonly described under the name of plates or bands. These are a kind of metallic springs, narrow and thin, adapted to the contour of the alveolar border, and applied in front or behind this border, according as the irregular tooth has deviated forward or backward; but better still, a double band, which gives to the thread a surer support, by hindering it from gliding upon the crown of the tooth, especially towards the neck. In order to explain their action and the mode of applying them, we will cite an example. Let us suppose an incisor thrown forward and having space enough to permit it to be reduced into line. We make the mold of the defective dental arch, as it will be described in the 'prothesis.' Then, upon the posterior and anterior faces of the teeth, we adapt a bandlet of gold somewhat less wide than the height of the teeth, but touching them all in the direction of the alveolar border, terminating at each of its extremities by a kind of bracelet, or better still by a true cap, which envelopes the two last molars, upon which we wish to take a firm support. Before applying this little apparatus, we pierce each bandelette with two holes in the same horizontal direction, and precisely at the point corresponding to the irregular or oblique tooth. Finally when it is applied, we pass through the holes a thread of raw silk waxed, or of platina, and twist them around the tooth to be replaced."

"This apparatus, which is the only one we employ, as it is much more sure than the simple thread, has this advantage, that its action is constant. This continuousness results from the incessant action of the spring reacting upon the thread. The power may be increased by so arranging the spring that it shall not touch the teeth which form the sides of the vacant space to be filled by the tooth to be retained. We have cited the simplest cause in which the band is applied, but it is easy to perceive that it might be used upon several teeth as easily as upon one. It is only necessary, in complicated cases, to pierce the bandeau with as many holes and pass through as many ligatures as there are irregular teeth."

"Whatever modern authors may say of the means we have described, claiming it as their own invention, and supposing upon the ground of some modification, that they have 'resolved a problem never before thought of,' it is nevertheless true, that it was known to the ancients. A detailed description of it may be found in Fauchard, and if our predecessors have not derived as much benefit from it as ourselves, it was because they did not avail themselves of firm points d'appui, a first condition in all apparatus of replacement. When one has become familiar with the mode of applying bandeaux, formerly called plates,

and which are nothing more than springs, he will perceive that they are only applicable to anterior and posterior displacements; but generally simple ligatures are used to correct lateral and rotated obliquities. In the first case, the thread is firmly fixed upon the last or even the two last molars of the side opposed to the deviated tooth, and we tie it upon the latter, causing it to pass in front of the neighboring teeth, when the tooth presents inwardly, and vice versa. This direction of the ligature exercises less traction between the two lines which the tooth must traverse in order to reach its place, for it is evident that if, in a case of inward lateral obliquity, an incisor for instance, the thread departed from the inward face of molars, it would only draw backwards, but not into the vacant space to be occupied."

"As to rotary deviations, they are generally corrected by surrounding the tooth with a strong silken thread, one of the ends of which is carried inwards, the other outwards, to be fixed upon the last molars. As these teeth, especially if they are incisors, leave sufficient scope, by the very fact of their movement, to the means to be employed for their restoration, we surround them with a little ring, which embraces them exactly, and bears in front and behind a small hook, into which the thread is received to go to fix itself upon the molars of each side,

Fig. 4.—Various appliances used by Desirabode.

either directly or by the intervention of a little cap placed upon these latter, or a small ring upon which a thread may be tied."

"Generally, by these and similar means, we may succeed, in less than a month in restoring a tooth to its natural place. In the course of treatment the ligature must be changed and readjusted every three or four days. When the desired end has been obtained, we sustain the tooth for one or two months, or more, by means of a smaller ligature or gold thread, until the alveolar border shall have acquired sufficient firmness to maintain the tooth in the direction given it; but what is yet better is to cause the patient to wear at night a kind of metallic capsule, fitting exactly upon the teeth, and enclosing not only the restored tooth, but those surrounding it."

"We may perceive the importance of this, if we remember the intensity with which the jaws are sometimes clenched at night. We have seen this so strong as to displace artificial pieces, when inconveniently arranged. It is well to take another mold of the mold after the success of an operation of this kind, as, by the comparison of this with the previous mold, we may better judge of the result in all its extent."

"We have remarked that besides ligatures there was another way to restore a deviated tooth to its natural direction. This means is incomplete luxation; as it is not without danger, it should never be tried except when the in-

efficiency of ligatures is well established, as in the case of an individual of twenty or thirty years old, in whose case one or two teeth should project with the alveolar border. If the operator concludes that the space destined for the distorted tooth is not large enough to receive it, he will file away the adjacent tooth and the displaced tooth, until the necessary size is obtained, when he will luxate the latter, and restore it to its proper position."

"Pincers will ordinarily suffice for this purpose; but in order to succeed it should be done with all possible care, and all effort should cease as soon as it is brought to the level of the others. It is then prudent to preserve it in its new place by ligatures. Some weeks will suffice, it is said, for the alveolar border to adapt itself intimately and render it as firm as before."

"But, we repeat it, this maneuver, which properly belongs to surgery is not only of doubtful efficacy, but may be attended with disastrous consequences. It is indispensable, indeed, that in practicing it, even with all possible care, we may not only break and tear the gums, tear the alveolo-dental periosteum, fracture the alveoli, but even break the tooth. Therefore, we have never undertaken it, and we advise all young practitioners to avoid it, or never attempt it until they have well balanced the changes."

"We have all along supposed either that the space proper to the tooth remained unoccupied, or that room could be made by extracting a tooth. When, however, there is nearly sufficient space it is not necessary to make such a sacrifice. The end can be obtained by filing slightly the sides of the displaced tooth or of those between which it is placed, as we have already said."

"*Pathology and Therapeutics.*—Of authors who have written on specialties on our art, some as Maury, holding no account of the relations of organization of the end which unites the dental bone and its central ganglion, content themselves with dividing the diseases of the teeth into those which relate to their hard parts and those which affect their soft parts; whilst others, as Lefoulon, having no very just idea of that which they ought to understand as diseases, have added to the number of those of their teeth, simple anomalies of form and of arrangement. More logical in this respect than those, we have arranged changes of the organs, which we shall now treat of into three distinct classes."

"The first includes the vital or pathological changes properly so called which, are injuries of the follicles; erosion or atrophy of the teeth; discoloration and decomposition of the enamel; consumption of the roots, caries and its different varieties; exostosis and the spinal ventosis; softening; inflammation; fungosity; ossification even of the dental pulp, and finally the different nervous affections of the teeth."

"The second comprehends, on the contrary, injuries purely physical, as the wearing away, cracking and fracture of the teeth; their loosening, fluxation and denudation."

"Finally we have arranged in the third class of the diseases of the auxiliaries of the teeth, either the diseases of the gums of an inflammatory nature, or the diseases of the alveoli."

C. J. Linderer (1837) in his "*Handbuch der Zahnheilkunde, etc.,*" gives an essentially different classification of irregularities of the teeth than the one of Kneisel's. In 1842-48 he brought out what was considered the best and most

important publication devoted to dentistry in the German language. His chapter on irregularities of the teeth is interesting and includes several novel means to correct these conditions.

Linderer believed in extraction of certain teeth when carious or diseased, even if they were permanent, but advocated the retention of the deciduous ones as long as possible, as they influenced the development of the dental arches. He also believed that if precaution is taken in time, prevention of irregularities of the teeth may be accomplished by retaining the deciduous teeth until the permanent set erupt, or the timely extraction of those teeth, by extracting a new tooth, and by means of the file when the teeth are crowded.

Linderer classification consisted as follows:

1. Impacted teeth.
2. Rotated teeth.
3. Open bite.
4. Teeth in unusual positions.
5. Slanting teeth.
    a. Inversion, or where teeth projected inward.
    b. Retrocession or where teeth projected outward.

He mentioned five ways of correcting or regulating the teeth.

1. Moving the teeth inward.
2. Moving the teeth outward.
3. Moving the teeth sideways.
4. Moving the teeth inward or outwards and forward and backwards at the same time.
5. Rotation.

He stated that this may be accomplished by means of the pincers and the pelican, by the use of the finger and by means of various appliances. Before beginning the treatment he recommended that a thorough study of the case be made and that one should be sure of the method of procedure, then procure the necessary expansion or room. Linderer advised early treatment because he felt that better results could be accomplished; he was also of the opinion that good results could be obtained even past the age of fourteen.

The means of accomplishing the work with appliances was by the use of wooden wedges, rubber plates, clasps as used by Maury, ligatures and bands, and the inclined plane of Catalan, Hunter, Delabarre, Kneisel and Schanage.

Linderer's early method (1837) consisted of double ligatures which were tied to molar teeth and wound around the teeth as required. To prevent the ligatures from slipping, another piece of ligature thread was tied linguo-labially and over the incisal edge.

The apparatus for widening the dental arches consisted of a rubber plate which was perforated for ligatures attached to the posterior teeth. Attached to the plate anteriorly were clasps that pressed against the incisor or posterior teeth as the case required. In this manner expansion was brought about.

Open bite cases were treated by means of extraction of upper or lower molars or both. In raising the bite Linderer also made use of the ivory blocks as advocated by Fox, or the gold caps or crowns. To rotate a tooth, a gold band

was used upon which a round wire was soldered, the free end being rounded, served for fastening the ligatures.

Edward Maynard (1843) "*The American Journal of Dental Science.*" "As no notes were taken during the treatment, I am unable to give the time required for each step of the cure. I saw the patient every few days, and made the applications herein described, as change in the positions of the teeth indicated their propriety. On the 7th of September, I extracted both the first superior bicuspids, and directed the patient to return as soon as the inflammation consequent upon this operation should have slightly subsided. Having met with an accident, he did not return for several weeks. At the next visit, I passed an elastic thread (made of sewing thread and gum-elastic) around behind the first molar and before the cuspidatus of one side; the two ends of the thread were then tied tightly, and the corresponding teeth of the other side were treated in like manner. These threads were several times renewed as shorter ones became necessary. As both sides were treated alike it will be sufficient to particularize the treatment of but one of them. Having drawn the cuspidatus about one line back, a thread was now passed between the bicuspids and first molar; then the end towards the cheek was passed between the first and second molars; this gave both ends toward the palate; then both ends were brought forward and tied tightly before the cuspidatus, thus changing the direction of the force by making the bicuspid serve as a pulley. But this pulley would serve as such but a short time, becoming, itself, loose in a few days. I then let the threads of both sides remain to keep the cuspidati from returning while the parts adjacent to them were allowed to rest a few days and recover from some slight soreness, and directed the treatment to the incisors."

"A slip of gum-elastic was placed between each lateral incisor and its adjoining central, which separated the teeth at these places about half a line. A stick of hickory pivoting was then split in two, and cut off the right length to reach from the depression in the back of one lateral incisor to that in the other. This was cut away toward each end so as to form a spring, thickest in the middle, where a non-elastic thread was tied fast. This spring was placed against the backs of the lateral incisors and held there by the patient pressing forcibly against its middle while both ends of the thread were brought forward between the central incisors and tied tightly over a thin stick two lines long of the same wood, laid across the space between the centrals. This carried the lateral incisors forward and outward, while it slightly rounded the angle formed by the centrals. This last effect was sufficiently produced afterwards by applying a like spring, in like manner, except that its ends rested upon the backs of the central incisors, at those parts nearest to the laterals."

"It will be seen from this account that no metallic bars, frames, blocks, hooks or spring,—in fact, no metal or anything of like rigidity was used. The patient attended to his studies and other duties as he would have done without the treatment; suffering little if any pain, and but slight inconvenience. Probably much less time would have been required for the operation, but for the accident which delayed it at the commencement."

Here again we find the use of gum elastic employed in the correction of irregularities of the teeth prior to the time of Tucker.

Sam Ghimes (1843) speaks of the underhung jaw being due to the "upper incisors extending inwards, and on closing the mouth they come in contact with the lower; this makes the child inclined to protrude the lower jaw, which finally becomes habitual, and promotes the increase of the length of the jaw itself."

Paul Goddard, in *"Anatomy, Pathology and Physiology of the Teeth,"* 1844, expresses the opinion that the most prolific causes of irregularity is want of room in the dental arches. This arises sometimes from congenital effects, but more commonly from early decay and loss of the temporary teeth which, failing to keep up the alveoli, enable the jaw to contract and thus afford too little room for the permanent set. Another cause is the position of the temporary teeth and the germs of the permanent teeth.

Goddard states that irregularity may be divided as follows: First, Irregularity of position and direction; Second, Irregularity of formation and shape; Third, Irregularity of number.

"The most simple form of irregularity in the cuspidati consists in an obliquity of position in their sockets, the face of the tooth turning either to the right or left, to a greater or less extent according to the want of room in the dental arch. This malposition arises from a total want of room for them in the dental arch and is consequently difficult,—exceedingly hard to remedy."

"It may be remarked that irregularity in the incisors, especially when it is confined to one or both teeth, is far more common in the upper than in the under jaw. The simplest and most common derangement is an obliquity of the lateral incisors, which is sometimes so great as to cause them to present their edge outwards; in this case the central incisors are more or less crowded together and occasionally form an angle with each other, the apex of which points either inwards or outwards, but is most common in the latter direction. Another deviation is the projecting backwards or forwards of a single tooth, generally one of the central incisors, which in some cases deviates so far from its proper direction as to grow directly inwards towards the tongue, or outwards, as if it would perforate the upper lip. In a third case, the incisors come down in their proper direction, but some distance too far back, so as to be in the roof of the mouth; this usually happens to the lateral incisors."

"The forms of irregularity treated of so far, are those which affect individual teeth, but it becomes a very important subject of consideration to the dental surgeon, when he is presented with deviations affecting the whole of the front set, upon which the shape of the face and the speech of the individual so much depended. The most common deviation affecting the whole mouth is the projection of the lower jaw over the upper, so as to produce a false closure as it is called."

"Now when this deformity—false closure, exists, the relative size of the teeth is not altered, consequently the lower jaw becomes deformed, is elongated and its angle rendered very obtuse. Anyone understanding the principle of the lever, will see that great loss of power in the muscles of mastication must result, and to this is added a loss of the lateral motion of the jaw masticating food properly. Occasionally the want of room in the upper dental arch is so remarkable that the teeth are forced to arrange themselves in two rows, and the

lower set closed in between them. The mouth in these cases is remarkably small, and there seems to be a congenial defect in the size of the jaw, the appearance produced being very curious."

TREATMENT OF THE FIRST FORM OF IRREGULARITY.

"In commencing an account of the treatment of these deviations, it may be well to remark that the age of the patient is a most important item to be considered in making up an opinion as to the probable success of surgical interference. Previous to the age of fifteen the remedies are very apt to prove successful, but after that the treatment becomes progressively more tedious, difficult and uncertain. If pressure is made upon one side of a tooth at any period previous to the completion of the ossification of the skeleton, it will produce an absorption of that side of the alveolus against which the fang is made to press out, being attended with a disposition of bone on the opposite side, *pari passu,* so that the tooth slowly changes its position without ever becoming loose in its socket. Having taken the age of the patient into consideration, and determined to proceed, the operator must next inquire into the causes producing the deviation from the normal state, and begin by removing them when practicable."

"The successful treatment of irregularity must also depend upon both the extent and nature of the deviation of almost every variety requiring either a modification or total change of treatment."

"When the incisors of the upper jaw come out irregularly, particularly when they are behind their temporary antecedents, these must be removed to make room, and even when the deviation extends only to the central incisors the four temporary require removal, for the permanents being broader than their analogues of the milk set, there will not be room enough made by their removal alone. After the required room is thus obtained, pressure made by means of a tooth-brush handle or a hickory stick and perseveringly applied by the patient will soon cause the affected teeth to take a correct position. Constant pressure with the thumb will suffice in many cases. When this deviation occurs to the incisors of the lower jaw, it will suffice to remove the temporaries as the tongue of the little patient will push them forward into their proper places."

"One of the most difficult forms of irregularity to remedy in the incisors, is obliquity arising from want of room for their normal arrangement. As their obliquity gives rise to much deformity, particularly in the upper jaw, it is important to pay great attention to its treatment. This must be commenced by making room for the oblique tooth. A file may be passed between each of the front teeth, taking care not to cut through the whole thickness of the enamel, and to carry the file well under the gum so as to clear the teeth completely. If this does not give room enough pieces of gum elastic must be squeezed in between the teeth and renewed every day or two. Its elasticity aided by the warmth and moisture of the mouth, will soon increase the space so that the subsequent part of the process may be commenced. Occasionally this mode of applying gum elastic will answer without filing, which should always be avoided if practicable. This plan of expanding the dental arch and thus separating the teeth will not answer as well for the lower jaw, because its size is limited by that of the upper jaw, and if filing should not afford room, one of them may be extracted, which will rarely excite observation."

"In those cases in which the teeth have come out in an improper position the treatment must be adapted which is applicable to the projection of the lower jaw beyond the upper, for the principle involved is precisely the same. The first step is to keep the jaws separated so that the teeth to be rectified should not meet or pass each other."

Edward Saunders (1844), *"American Journal of Dental Science."* "Having pointed out the means of correcting that form of irregularity which consists of inclusion or recession, and which results from the upper tooth passing behind the lower row on closing the mouth and consequently being founded within the dental arch, it now remains to consider the mode of reducing such teeth as are external to it. These cases have as mechanical causes the pressure of contiguous teeth, arising from an overcrowded state of the mouth, a want of expansion of the maxillary bones, or an irregular state of the opposite rows, and those which are altogether independent of these causes, and are due to a preternatural development of the upper jaw forwards, combined more or less with lateral contraction. In the former, the indications are of course to liberate such teeth by expanding the arch, or by removing one or more of the adjacent organs, according to the peculiarities of the case. It frequently happens that with inclusion of the lateral incisors, there occurs protrusion of the centrals, while the former are locked in by the cuspid teeth, which usually occupy a prominent position. If in these cases the teeth are not disproportioned to the maxillary bones, and especially if the denture be flattened at the sides, or opposite to the angles of the mouth, regularity may be affected without the sacrifice of any of the teeth."

"A plate of gold or silver is adapted to the palate and gums as far as the bicuspid teeth on either side, to which it is firmly united by a ligature on each side. One end of a piece of tightly coiled gold wire is attached to some point near to the posterior margin of the plate while the other is fixed, in a state of tension, by means of a silk or wire ligature to the irregular tooth. A convenient method of uniting the spring to the plate is to screw it on to a piece of wire bent at right angles, and soldered to some point in the direction in which it is desired to use traction upon the tooth; its free end may be readily secured upon the irregular organ by turning down the two final rings so as to form a loop, through which a ligature or fine wire may be passed. This case obviously belongs more to second class deformities rising from preternatural development of the upper jaw, inducing a protrusion of the teeth in the anterior part of the denture. These are not only more difficult of reduction, but exhibit more or less tendency to regain their old position, a tendency further increased by the habit of closing the mouth with the upper incisors external to the lower lip."

"A strong bar is adapted to the external surface of the teeth of the superior denture, having its attachment to the molars. The lateral incisor on the left side is within the dental arch, while the right central is developed prominently forwards. Opposite to the latter is a screw, which may be turned by a small key; for the education of the lateral is a complete windlass, to the roller of which the two ends of a ligature are secured, which has passed behind the irregular tooth. In all cases in which it is required to bring the tooth inwards, one practical obstacle presents itself in the swelling and puckering of the gum, arising from the absorption taking place more slowly in the lateral structure than in the

alveoli of the maxillary bones. To obviate the difficulty arising from this cause, it is desirable to leave the edge of the plate free posterior to the teeth about to be moved, and cut away or raise it, from time to time, as may be found necessary. Notwithstanding these precautions, however, the gums may become so soft and irritable and in such a state of congestion as to make it desirable to discontinue the use of the plate for a brief interval. Under these circumstances the simple bar of gold external to the teeth secured to the molars and made to exert pressure by means of wooden wedges upon the irregular teeth, is a valuable and efficient substitute."

Charles Marmont (1844) in *"La distole on methode—de la bouche,"* advocated extraction of teeth, especially the first permanent molar, in order to move the premolars back, so that the cuspid might move into its proper place. He also laid claim to being the originator of the idea of expansion of the dental arches.

Robert Arthur (1845) in *"A Popular Treatise on Diseases of the Teeth,"* stated that "Irregularities of the teeth may proceed, among others, from three principal causes; First, the presence of a greater number of teeth in the mouth than is natural, second, a deficiency of space in the jaws; third, a wrong direction given to one or more at the time they make their appearance. A deficiency of space may rise from a contraction of the jaws in consequence of the too early extractions of the temporary teeth; from some original malformation of the jaws, or from a great excess in size of the second set over the first."

"It was for a long time, the opinion of a large part of the community that, if the teeth of the first set are allowed to fall out, naturally those of the second set will be irregular. It being necessary, consequently, to force the poor child to a dentist, before the teeth were even loosened and have them dragged out, regardless of pain inflicted for the purpose of insuring a regular set of teeth."

"We have pointed out the circumstances attendant upon a natural and orderly change of the teeth; but this change, as we have already intimated, is not always accomplished, with so much regularity; it may, from various causes, be disturbed. The secondary teeth may be diverted from their natural course in various ways, and much irregularity in their arrangement produced. As the order and time of the shedding of the teeth are now fresh in the memory of the reader, this seems to be the most proper place to introduce such directions, for the management of the second dentition, which will, if put into practice, prevent these irregularities, and their injurious consequences."

"At the time when the temporary teeth are about to be shed, the mouth of the child should be frequently and carefully examined, and, as the front teeth are generally the subjects of irregularity, this attention should be particularly directed to them. As long as there are no signs of the coming of the second set, the first teeth should be allowed to remain undisturbed, but the moment the cutting edges of the central incisors are seen piercing the gum, either on the outside or inside of the alveolar arch, the two temporary incisors, if they are still remaining, should, without delay, be extracted. A little time should now be allowed to elapse, and, when the central incisors rise in their sockets, if there is not sufficient room the two temporary lateral incisors, if they still remain, should be removed. The permanent central incisors, if no other obstacle is pres-

ent, will now take their proper places, but as soon as the lateral incisors appear, the canine teeth, if there is not room, must, in like manner, be removed. After this it will rarely be necessary to extract any more of the temporary teeth for the purpose of preventing irregularity, and it will generally be found that if there is still a want of room in the jaw, that the canine teeth, which come last, will be thrown out of the arch. The method of correcting this irregularity will be shown presently. In cases, however, where the permanent canine teeth make their appearance before the temporary molar teeth are shed, and these do sometimes present themselves, it will be found necessary to extract the latter to give room."

"We must here take occasion to depreciate an injurious custom which had its origin in a most strangely founded popular prejudice, but which, at present, has, we are glad to believe, passed almost entirely out of use. To some extent, however, it is still practiced. It was, for a long time, the opinion of a large part of the community (and it conflicts, strangely, with their ideas of the efficiency of nature in some of her other operations) that, if the teeth of the first set are allowed to fall out, naturally, those of the second set will be irregular when they make their appearance. It became necessary, consequently, to force the poor child to a dentist, before the first teeth were even loosened, and have them dragged out, regardless of the pain inflicted, for the purpose of insuring a regular set of teeth in after life. If there were no other objection to the extraction of the first teeth, at this time, than that it is the infliction of unnecessary pain, that would be sufficient to condemn it; but, instead of preventing, it will cause future irregularity of the second teeth. If these teeth are removed before the second teeth are ready to come up, a permanent contraction of the jaw will take place, and, as there will not be sufficient room for the second teeth, when they do appear they must be more or less crowded together. It must not be supposed that this is mere theory (although as theory it is in perfect accordance with what might, under such circumstances, be expected to take place); experience has proved, in a great number of instances that it is an invariable result. Besides this, a too early extraction of the temporary teeth, by breaking up the connection between the two sets, may so disturb the growth of the permanent teeth as to stop their further development, or to divert them from their natural course."

"The first teeth should never be extracted except when it is found that they are in the way of those of the second set, or when they are so much diseased as to affect injuriously the surrounding gums and sockets. When toothache occurs, it may be readily and permanently relieved by the preparation which will be indicated when we come to treat of diseases of the permanent teeth."

"But, although the second teeth may have taken the most irregular positions in the jaws, the deformity is not beyond the reach of remedy."

"1st. The presence of supernumerary teeth, although not of very common occurrence, is a more or less frequent cause of irregularity. The degree of irregularity may be confined to that produced simply by their presence near the regular dental arch, or they may displace some of the other teeth. They are generally formed near the front of the mouth, most commonly on the inside of the upper jaw, but are sometimes found as far back as the wisdom teeth. They

are usually isolated, but cases are recorded of duplicates of all the incisors of the lower jaw. The crowns of these teeth are generally of an irregular conical form; they have short, crooked roots. Wherever they are present, they should, without hesitation, be extracted. Great caution should be observed, however, to be certain that irregularly situated teeth belonging to the natural set are not taken for supernumerary teeth. This may always be determined when they occupy the front part of the mouth by examining whether the ordinary number of incisors and canine teeth are present. Any irregularity which they may have produced in the arrangement of the rest of the teeth must be corrected in the manner presently to be shown."

"2nd. The second cause of irregularity, a deficiency of space in the jaws for all the teeth, is of most common occurrence. This may arise from a contraction of the jaws, in consequence of the too early extraction of the temporary teeth; from some original malformation of the jaws, or from a great excess in size of the second over the first teeth."

"It would be impossible to enumerate the variety of unsightly irregularities dependent upon this cause; it may be useful, however, to mention some of the most common. The whole of the upper incisor teeth may project in such a manner as to throw out the lip considerably, and display their cutting edges when the mouth is opened. One or more may be thrown out of the dental arch, which will be nearly or entirely filled without them; this is a very common form of irregularity of the canine teeth. The whole of the front teeth of both jaws may be so much crowded together that the crowns will deviate in almost every direction from a regular position; cases frequently occur in which the lateral surfaces of the incisor teeth present towards the lip. The lower incisor teeth may project beyond the range of those of the upper jaw instead of closing within them as they do naturally. But the varieties which occur are, as we have already said, innumerable."

"The principle upon which irregularities of this kind are corrected is, however, the same in all cases. The first indication is to obtain the necessary space to allow the irregular teeth to come into the arch; and then, by means of various mechanical appliances, to press them into their proper places. Directions for moving the teeth, after they have become fixed in their sockets, will strike those who have not thought of the subject, very strangely, and they may be disposed to think that it cannot be done without more or less injury. But up to the age of sixteen years, and in some cases even after that period, it may be done to considerable extent with ease and safety."

"The necessary space required for the correction of irregularities of this kind is generally obtained by the removal of one or more of the teeth, even though they should be perfectly sound. In the extraction of teeth for this purpose, and we now suppose that all the second teeth with the exception of the last molars have made their appearance, the bicuspids being the least important, should be chosen, unless some of the teeth near them are so much decayed that their preservation is impossible. Generally, the second should be taken instead of the first, but this will depend entirely upon the circumstances attendant upon each particular case. The cuspids are, perhaps, more subject to irregularity than any of the rest of the teeth, in consequence of the manner in which they are

thrown out of the arch, whilst the bicuspids are taking the place of the temporary molars; for it sometimes happens that the arch is almost entirely filled up before they make their appearance. These teeth should never be extracted when they are in such a situation that by removing the adjoining or second bicuspids they can be pressed into their proper places; and the instances are rare, if indeed they ever occur, in which this cannot be done. It is, also, very improper to extract any of the incisor teeth when they are much crowded, especially in young persons, as the loss of one of these teeth destroys the symmetry of the whole set, even if the space it occupied should entirely close up by the approximation of those adjoining."

"It is frequently the case, when the irregularity is not very great, and there is no obstacle in the way of their return, that the irregular teeth, after the requisite space has been obtained, aided by the constant pressure exerted by the lips from the outside, and the tongue from the inside of the mouth, will soon fall into their proper places. This, however, does not always happen, and we are compelled to resort to mechanical fixtures for the purpose of obviating obstructions, and to move gradually the deviating organs into a regular position. We cannot do more than describe the means which would be used in one or two special cases; the apparatus must, of course, vary with them. This will serve, however, to show the manner in which the object is effected."

"In a case where one of the lateral incisors is thrust out of the arch toward the inside of the mouth, the central incisor and eye-tooth nearly touching, one of the bicuspid teeth, either the second or first, according to circumstances, must be extracted. After the place from which it was taken has healed, the eye-tooth should be gradually moved back toward the remaining bicuspid, by inserting a thin wedge of paper between it and the irregular tooth, increasing it from day to day in thickness. It should be prevented from returning to its place by passing a ligature around it and the first grinding tooth. Although in this manner sufficient space will soon have been gained to afford room for the irregular tooth, it will generally be found to pass, when the mouth is closed, inside of the circle of the lower teeth. This, it will readily be seen, will be an insuperable obstacle to its coming forward, if left to itself, for the constant tendency of the lower teeth, every time they strike, is to press inward. The usual method of removing this difficulty, and of bringing the irregular tooth into its place, is to attach a bar of gold or silver to one of the first grinding teeth, on each side, and bring it forward in front of the incisors. At the place opposite the deviating tooth two holes are drilled, through which a ligature is passed, fixed around the tooth and drawn firmly. To prevent the teeth of the lower jaw from striking against the irregular tooth, a gold cap is fitted upon one of the molars, which will not allow the jaws to come quite together. The ligature is drawn tight, every day, until the tooth is moved sufficiently forward to strike on the outer surface of those of the lower jaw; at which time the whole apparatus may be removed, without fear that the tooth will fall back into its old position. This special case will serve to show the application of the principles upon which the correction of irregularities is founded; in the same manner those of the most unsightly description may be remedied."

"It may be well to state that few cases of irregularity of the incisor teeth

occur in which the extraction of a bicuspid tooth of one side of the mouth will be sufficient. By this, in many instances, the desired space may be obtained, but the tendency of the whole of the teeth, if the jaw be full, will be toward the vacant space, and it is easy to perceive that this would produce a deformity almost, if not quite, as bad as that caused by irregular teeth. But many cases occur in which it will be unnecessary to extract any of the teeth; all that is required being merely an apparatus fixed so as to throw out the whole of the teeth, thus giving the arch greater compass to admit the irregular teeth."

"3rd. The third cause of irregularity of the teeth is, as we have said, an improper direction given to them at the time they make their appearance; this may be confined to one or more, or may affect the whole of the incisor teeth of either or both jaws. In the case of the irregular lateral incisor mentioned above, it is seen that even after sufficient room was obtained by the extraction of one of the bicuspids, that it could not come forward, in consequence of the obstacle presented by the teeth of the lower jaw. In precisely the same manner may one or more of the upper incisors come out back of their regular place in the arch of the jaw, in consequence of the too long retention of the temporary teeth, or other causes, and be unable to come forward, even after the obstacles which first presented themselves have been removed—because, at every occlusion of the jaws, the teeth of the lower jaw strike against their external edges. This irregularity, which is a very serious one (for as the compass of the mouth is much reduced, indistinctness of articulation is caused), is corrected by attaching to the lower teeth plates of metal, so inclined as to strike against the inner surfaces of the upper teeth, thus constantly pressing the former inward at the same time that they force the latter outward. In this case, as in the other mentioned, the jaws must be kept from closing entirely by the use of a gold cap fitted to a molar tooth.

Nasmyth in "Researches on the Development, Structure and Diseases of the Teeth" (1845) stated that "Projecting upper jaw is often the result of a habit of sucking the tongue or finger in infancy. But both projecting upper and projecting lower jaw arise from an arrest of development in the jaw when expansion of the arch is deficient." He also states that the prominent mouth is found in uncivilized races.

James Robinson (1846) in *"The Surgical, Mechanical and Medical Treatment of the Teeth,"* says, "There is no branch of the dental art on which there exists greater diversity of opinion than on the treatment of the irregularities of the second dentition."

According to Robinson the etiology of irregularities of the teeth are the early loss of the deciduous teeth, premature eruption of the permanent teeth, or extraction of the deciduous teeth.

If the permanent middle incisors of the lower jaw erupt in front of, or in back of the milk teeth, it is then advisable, he says, to extract the temporary incisors, and if the necessary room for the coming teeth is lacking, it is best to extract both, or, according to the circumstances, one of the incisors on the side. But this should be delayed until one is entirely convinced that the necessary expansion of the jaws has been procured. He also advises that the wisdom teeth be extracted where the teeth are in a crowded condition.

Robinson considers the prognosis of all cases of irregularities favorably, even at an advanced age.

Charles A. Du Bouchet (1847) in the *"Dental News Letter,"* relates a case where the deciduous incisors were broken off close to the gum. The roots soon decaying, were extracted, leaving a vacancy in the middle of his upper dental arch, which was not filled by his permanent incisors until his fourteenth year. In the meantime the alveolar process became absorbed quite as much as in a subject far advanced in years, and formed anteriorly a deep cavity into which his upper lip sank, giving a peculiar expression to his features.

"To this apparent absorption and condensation of the alveolar process do I attribute the scattering and irregular growth of his second dentition, which likewise may be accounted for, by his being afflicted as I have stated."

"These irregular teeth, to the number of three, being all very much decayed, I extracted, as well as the left central incisor. The gums healed very promptly. At the present time, the anterior depression of the alveolar is entirely filled up, the gums have not shrunk, and his mouth is restored to a normal appearance as will be seen by looking at the cut, the two ill-shaped teeth in the median line grew in the place occupied by his deciduous central incisors, and were consequently an extra pair provided by nature to retrieve his early loss."

Samuel C. Harbert (1847) in his *"Practical Treatise on the Operation of Surgical and Mechanical Dentistry,"* states: "Irregularities of the teeth are due to the premature extraction of the deciduous teeth and protrusion of the permanent before the absorption of a deciduous fang. A projection of the lower jaw is attributable to neglect in second dentition; generally it is supposed to be due to elongation of the jaw, which is almost always an error. When the dental arch becomes contracted at the medial line giving to the mouth a pointed appearance, it is often the result of premature extraction of certain of the temporary teeth.

Irregularity of the teeth.—"It is seldom that any disorder exists in the arrangement of the primary teeth, or is it a very important matter, as the early loss of these teeth, by natural causes, must take place before the evils of crowded teeth would be felt."

"The free, unobstructed state of the gums, prior to first dentition, offers no obstacle to the progress of the infant teeth, and they, consequently, emerge in a regular and symmetrical manner, while the second set, operated upon by different causes, are very frequently forced into a crowded and irregular group, a condition prejudicial to their appearance and health."

"The irregularities of the permanent teeth may be generally attributable to two principal causes,—the premature extraction of a deciduous tooth, by which an absorption of the parts takes place, and the adjoining teeth are brought in contact to the exclusion of a succeeding tooth; and the protrusion of a permanent tooth, before the absorption of the deciduous fang."

"The evil consequences of crowded or irregular teeth are so apparent to everyone as to demand every necessary care in the avoidance of it. There is no feature of the face more conspicuous than the mouth, upon the beauty and symmetrical form of which depends its grace and elegance. A very frequent deformity of the lower jaw, a projection occasioned by the lower teeth closing out-

side of the upper ones, is mainly attributable to neglect in the second dentition; generally it is supposed to be caused by natural elongation of the jaw, which is almost always an error, as the first is the principal and most frequent cause."

"The teeth most liable to derangement in their order, are the incisors and cuspidati of both jaws."

"The upper cuspidati often protrude above the crowns of the adjoining teeth, either upon the outside, by which they become a serious inconvenience in causing a prominence of the lip; or upon the inside, proving an obstacle to the tongue in its articulation."

"The upper teeth are sometimes found to incline with their cutting edges to the inside of the mouth, the opposite teeth closing outside of them. As this generally appears to be a natural disposition, it is more difficult of correction than any other kind of disorganization, and should be treated with hope of success in the early progression of those teeth."

"Another species of irregularity, by which the dental arch becomes contracted at the medial line, giving to the mouth a pointed appearance, is often the result of a premature extraction of certain of the temporary teeth, producing an undue absorption before the advancement of the permanent ones; thus confining them to a less space than they should occupy, and crowding them into an elliptical form instead of the regular circle."

"To avoid the evils of crowded and irregular teeth, proper care should be exercised in maintaining the health of the primary set to keep them from decay and the necessity of extraction before the proper time for their moulding and succession of the permanent teeth."

"The mouth should continue to be examined, during the whole course of second dentition at frequent intervals and the peculiar characteristics explained to the child's parent or guardian that they may be able to guard against the causes that operate in producing irregularity."

Treatment of Irregularity.—"The teeth may be altered in their relative positions to each other by a proper course of treatment. Any required change should be made before the patient exceeds fourteen or fifteen years of age; after that time the probabilities are against success, though not without hope. I have succeeded in correcting a very prominent deformity in the teeth of individuals several years older."

"If the dental surgeon is consulted before the entire completion of the second denture, and any of the deciduous teeth remain in opposition to a regularity in the advancement of teeth belonging to the second set, he should at once extract the opposing tooth. It is frequently necessary to remove more than one—the permanent tooth being larger than the temporary one, requires more room. In every case where the extraction of a second tooth is considered necessary, the one posterior situated should be preferred as it gives an opportunity for the teeth to spread, and a consequent enlargement of the dental circle. If, as is frequently the case, the whole course of dentition has been allowed to proceed unassisted, and the teeth, instead of presenting a systematic arch, appear in a confused mass, he must then use mechanical means to remedy the neglect."

"If the upper teeth, or a portion of them strike inside of the lower ones on the occlusion of the jaws, it may, when only partially so, be overcome by direct-

ing the patient to use a piece of ivory, flat on both sides, and held by one end, with the other resting upon the anterior side of the lower and posterior side of the upper teeth, and closing the jaws whilst held in that position, but as it is difficult to ensure a constant practice of it, a more certain and convenient recourse should be had."

"I have, with universal success, substituted a metallic regulator acting upon the same principle. By obtaining a cast of the mouth, a plate is made to fit the posterior side of the teeth, with the end clasping a molar on each side of the teeth. Upon the clasps a cap is soldered to fit the teeth on their grinding surfaces, which, meeting those of the opposite jaw, prevent their entire occlusion. Another piece is also soldered to it to cover the cutting edges of the teeth that are to be corrected, and inclining in a position the same as would be given by the ivory. A very short time will suffice to change the relative position of the teeth. After they alter enough to allow them to close naturally the regulator may be removed, the power of the jaw being sufficient to force the teeth into their proper place, when once they have received the necessary inclination."

"When the front incisors are situated with their central edges turned out, it is generally occasioned by a contraction of the jaw, and an insufficient amount of room for the necessary number of teeth; the only remedy is to extract the first bicuspids of each side; the other teeth will gradually fall back until the spaces occupied by the teeth that have been removed are filled up; and the irregular incisors will regain their proper situation."

"It has been a common practice when the lateral incisors are crowded out to extract them, thus bringing the cuspidati forward to occupy their places, though in a line with the front teeth; the error of this practice would appear evident to anyone, could he see the result. The same mode of treatment suggested to correct a prominence of the centrals should be resorted to in this case."

"A protrusion of the eye teeth above the crowns of the adjoining ones may be remedied by the extraction of the second bicuspids; if the first one be decayed or deranged in its position, or from any sufficient cause, it may be preferred to the second; but in the absence of a particular motive a choice should be given to the drawing of the second bicuspid."

"When these teeth are thrown entirely from the dental circle and are shut from sight upon the closing of the jaws, but little prospect can appear of bringing them out to their proper place. The operator must judge, from the circumstance of the case, the practicability of extracting a bicuspid, and by the aid of ligatures to the adjoining teeth forcing the tooth into the circle, or an extraction of the errant member; if the first expedient is adapted, it will be necessary to obviate the pressure of the opposite teeth as already recommended."

"To correct an unnatural occlusion of the front teeth, is the most difficult of all defects to remedy. The only way by which I have ever been able to effect an alteration has been by resisting the pressure of the jaws and preventing the teeth from coming in contact, and by removing the lateral bearing of one tooth, against another; the first is to be accomplished by inserting caps upon a molar tooth of each side stamped between a die and lead, to make them fit accurately. The second by extracting a bicuspid from each side; after which, by a constant pressure exerted upon the posterior edge of the front teeth, they may

be ultimately forced out, until they close outside of the lower teeth; an apparatus such as described, modified to suit the peculiarities of the case, might be used to advantage."

"Of the many practices suggested for the correction of irregularity, that recommended by Mr. Bell, of filing the teeth to obtain space, is the most to be depreciated. Ligatures are also objectionable, as the silk or thread used is liable to force its way upon the neck of the tooth and under the gum, producing inflammation and injury to the parts."

(To be continued.)

Boil It Down

IN too many articles printed in dental journals, the effort seems to be to pad with verbiage. One of the great sins of writers, if not the cardinal sin itself, is to employ more words than are necessary to tell the story. This is an age of concentration and condensation, and the man who wants his articles to be read must learn to eliminate the superfluous. It is the short, crisp, trimmed-to-the-minute article that appeals to the modern reader; the article that goes straight to the core of the subject and digs out the essential facts, leaving the introduction and peroration to the imagination. Some articles have so much introduction, and such a never-ending conclusion that if the reader wades through all of it he has lost sight of the real essence for which the article was supposed to be written.

And strangely enough in many instances the verbal excursions in which writers indulge have little relation to the subject being discussed. There is a tendency to ramble, to go off into the by-ways of the subject rather than stick to the main thoroughfare. All of this tends to obscure the meaning which the author wishes to convey, and thereby to weaken the force of his argument. It is safe to say that most articles published in our journals would be greatly strengthened by being "boiled down." We once heard a man who is himself a very prolific writer make the statement that no paper written for a dental society should be longer than 3,500 words. We think that there are exceptions to this, and that some topics under certain conditions will require a longer treatment than this for their proper elucidation, and yet in the main we believe he was right. The very best paper will become tiresome if it is too long, and what is tiresome to listen to will likely be tiresome to read.

A good plan for a writer is to think intensely on his subject before committing anything to paper. Let him make headings of the various points which he wishes to bring out, and then when all is formulated let him put it on paper. After it is written let him lay it aside for at least a week—better a month. Then he should deliberately revise the paper and see how much useless writing he can eliminate from it. It will usually be found that after the first flush of composition is over many irrelevant passages can be taken out to the great improvement of the paper. A writer owes it to his readers that what he presents for their consideration shall be in the very best form, and while many men who have excellent ideas do not find it easy to express them on paper, yet most of those who write for dental journals can greatly improve their product by a general process of "boiling down."—*The Dental Review.*

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

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CLINICAL AND RADIOGRAPHIC EVIDENCE THAT CROWN AND BRIDGE-WORK IS A MENACE

BY JULIO ENDELMAN, D.D.S., *Professor of Dental Pathology, and* JAMES D. McCOY, D.D.S., *Professor of Orthodontia and Radiography, College of Dentistry, University of Southern Califoria, Los Angeles, Cal.*

THE method of dental restoration with its many faults and fewer virtues which is upon this occasion our privilege to discuss is generally considered in the light of a relatively modern addition to the prosthetic department of dental surgery, and the present status of the art of replacing lost teeth, or portions of them by means of the system known as crown and bridge-work, we frequently regard, with no mean degree of pride, as a reflection of the course in the ascendency which dentistry has been so assiduously following in the past decades. A closer investigation, however, into its history will reveal the astounding fact that crowns and bridge-work of the present day had its origin in antiquity and that while its technic has since undergone a progressive evolution in point of the numbers of teeth saved or the numbers of teeth substituted, with physiologic permanency, the system has, we believe, almost entirely failed.

The first formal arraignment of this method, which the dental profession was loathe to endorse, is to be found in the initial article of the series on oral sepsis, by Dr. William Hunter of the Charing Cross Hospital of London. This analytical writer's seemingly strong and at the time unwarranted indictment of crown and bridge-work appears now, after a detailed investigation covering a period of several years, as a decidedly conservative condemnation of the method, for while it may have been the source of temporary comfort to some patients it has on the other hand silently undermined a number of lives at present well-nigh impossible to compute.

The insertion of crowns that are to play the part of supports for bridges is closely associated with the question of whether or not such abutment teeth should be deprived of their pulps. While practitioners have at no time found it logical to accept without qualification either side of the proposition, but have decided the matter on the basis of the personal judgment of existing conditions, the results in a multitude of cases have been far from satisfactory. These cases which for purposes of elucidation we may designate as "the frank infections" have not, however, meant anywhere near the injury to the general health which the hidden type has been responsible for, ever since the widespread employment of crown and bridge-work. The removal of the pulp prior to crowning vital teeth

has been chosen as the lesser of two evils, as the means of forestalling its disorganization and death subsequent to the completion of the crowning or bridging operation, basing this preventive procedure on the clinical evidence gathered through decades of observation on the ultimate fate of pulps under gold-shell crowns. It has been a case of anticipating by mechanical and therapeutic means the complications accompanying death of a pulp, heralded or not by symptoms indicative of the pathologic changes occurring within its substance. How successful our efforts in this direction have been is a phase of the series of questions we will consider at this time, with the view of adding to the possibilities of a future solution of the problem.

Crown and bridge-work, of course, differs from other prosthetic devices in that even when not constructed with the utmost regard to accuracy of adaptation, it apparently continues to serve its purpose for months if not years, but then, in most cases, at a cost to the wearer to be measured not alone by the loss of the anchor teeth, by impairment of the functions of the neighboring teeth, by unbalanced masticatory movements, but by infectious inflammatory phenomena in its alveolo-dental articulation and soft tissues of the mouth, the starting point of disturbances in the thoracic, abdominal and pelvic viscera, in articular and muscular tissues and in the composition of the blood, which not infrequently terminate in an untimely grave. The fixed character of crowns and bridge-work with the so-called self-cleansing spaces, self-retainers of bacterial pabulum, is responsible for more cases of pericemental infection, than any combination of causes which suggests itself at this time.

Crowns, whether gold-shell or Richmond, involving in the latter case extirpation of the pulp, and in the former case the same procedure either as a measure of necessity, or one of prevention, demand close scrutiny at this time with the view of recording such observations as it has been in our province to make affecting the ultimate result of root-canal operations.

With the advent of the x-ray the element of doubt heretofore so conspicuous in this type of operations, in their diagnosis and post-operative phases, has been almost entirely eliminated and we are today in the fortunate position of being able to discern with clearness most of the conditions which follow the removal of a pulp, and the obliteration of the space in which it was housed by such means as are at the command of every dental practitioner.

We shall now enter upon a consideration of those features in crown and bridge-work which are an integral part of the mechanism of substitution, and which play so significant a role, directly in the etiology of mouth diseases, and indirectly in that of systemic manifestations. We cannot undertake this task without first recalling to your minds the distribution of the most important tufts of pericemental fibers, in order to more clearly bring out the fact that the slightest interference with the marginal gingivæ results in degrees of not only marginal gingivitis, but likewise of marginal pericementitis. As bearing upon this aspect of the question, permit us to mention only those groups of fibers which are distributed to the gingivæ and septal tissues, and which run from the pericemental membrane to the unattached gingivæ and to the tissues which normally fill up the interproximal space. Any degree of impingement upon the free gingivæ or the septal tissues must and does result in a peripheral gingivitis and

also in a peripheral pericementitis. The cervical edge of a crown is usually constructed so as to reach either way below the free gingivæ, slightly below or just in apposition to it. When made to reach for a distance under the free gingivæ it induces a degree of irritation which soon leads to chronic inflammation of the investing tissues. When made to reach slightly under or when it just merely touches the gingival edge, the degree of irritation which it causes leads to a slowly developing inflammation, but as in the previous case marks the onset of more deeply seated gingivitis and pericementitis, the precursors of extra-osseous focal infections. The edge of a crown—or should we not say edges of most crowns—act in their disease-producing capacity in two ways—by inducing a purely mechanical irritation, the antecedent of an infectious inflammation and by the retention which they make possible of food particles which, when they undergo fermentation or putrefaction, as the case may be, give rise to end

Fig. 1.

products, acid or alkaline, which further intensify the inflammatory process. In the construction of individual or assembled crowns any factor which makes possible the interference with the physiologic functions of the gingivæ and septic tissues is the precursor of gingival or pericemental diseases and so far basing our conclusions on our own clinical experience and that of many other co-workers, the percentage of crowns and bridges which do not set up chronic inflammations in these areas, by primarily interfering mechanically with their vitality, is so appallingly small as to render unnecessary any attempt at arithmetical accuracy.

Kindly bear in mind that the incidence of an inflammation in the septal or gingival tissues is the beginning of a chain of reactions to bacterial and chemical irritations which results in time in the invalidism and loss of the abutment teeth and that which is by far worse, namely, the extra-osseous areas of bacterial and

toxin absorption which preceded their exfoliation and which following a silent and evasive course not infrequently clutch the victim in the antennæ of unrecoverable disease. An important observation we have so far made is that some of the most marked systemic manifestations which develop from focal infections in the jaws which it has been our privilege to study, have been in patients in whom these pathologic conditions in crowned teeth gave rise to absolutely no

Fig. 2.

symptom in the mouth, either subjective or objective, and were discovered accidentally or following an effort at diagnosis by elimination of some obscure deep-seated disorder. For instance:

CASE-REPORT NO. I.

Young woman, aged about thirty-five, has been for years the sufferer from gastric and intestinal insufficiency. She related no sense of discomfort in the mouth. Her appearance was extremely toxic; she felt draggy and had lost most of the ambition normal to a person of her age and surroundings. In the effort to discover the causative factors of the unsatisfactory state of her health, everything else having been eliminated, she was referred to us. A focus of infection under a crowned lower first molar was found, which had at no time given the slightest evidence of its existence (Fig. 1).

CASE-REPORT NO. II.

Man aged about thirty-five, had been in excellent health up to the time of the insertion of a crown on a lower first molar. Since then his health has been impaired; it had been gradually becoming worse until a few months ago when he exhibited symptoms of chronic endocarditis. This man at no time had any symptoms that could have been interpreted by any stretch of the imagination as the manifestation of disease in or around the teeth. This radiograph was made in the course of our investigations on the condition of crowned teeth. It will be observed (see Fig. 2) that a decidedly well-marked focal area exists between and around the mesial and distal roots, and that the infectious process has

spread so as to involve the distal side of the root of the second bicuspid. It appears that since the proper dental treatment was instituted, the patient's health has been gradually improving.

CASE-REPORT NO. III.

While no history is obtainable concerning this case, we do know, however, that the patient was in utter ignorance of the continuous infectious process going on about the root of the lower first bicuspid which had carried a gold shell crown for years (see Fig. 3).

CASE-REPORT NO. IV.

This patient complained of pain in the mandible. Upon radiographic examination nothing abnormal could be detected in the area suspected by the patient, but two well-defined focal areas are to be seen upon the upper bicuspid teeth upon the side where the pain was manifest. Both of the affected teeth carry crowns (see Fig. 4).

Fig. 3.

Fig. 4.

Fig. 5.

CASE-REPORT NO. V.

The history of this case is of unusual interest. No painful symptoms at any time; no discomfort in any part of the mouth. Upon examination a focal area was detected

between and about the roots of a crowned lower first molar (see Fig. 5). This patient for some time had been a sufferer from rectal abscesses, which were most unresponsive even to surgical treatment. The treatment of the tooth has resulted in an amelioration of his general condition, including the infectious process in the rectum.

CASE-REPORT NO. VI.

Here again a marked infectious process is going on in the area of the roots of the upper central and lateral incisors producing no objective or subjective symptoms whatsoever (see Fig. 6).

CASE-REPORT NO. VII.

The lower molar had been supplied with a crown which the patient was wearing temporarily as it was to have been used as one of the piers for a bridge (see Fig. 7). This patient complained of some very slight discomfort in the molar. If the x-ray had not come to the dentist's and patient's assistance, doubtless the operation would have been completed and the bridge would have been cemented in. The radiograph shows a very large focal infection and one which no therapeutic means of any kind could possibly eradicate. This is strictly a surgical case.

Fig. 6.

Fig. 7.

In addition to the two disease-producing factors already discussed, i.e., root-canal operations and impingement upon the gingival and septal tissues, that is to say upon the areas of distribution of the extra-alveolar pericemental fibers, by the cervical edges of shell crowns and banded pivot crowns, there still remains

to be considered the deleterious effects upon the soft tissues of the mouth of retained food debris and the action and effect upon the dento-alveolar articulation of the artificial ankylosis caused by a piece of fixed bridge-work. That all forms of full dummied fixed bridge-work are filthy, we believe no one would attempt to gainsay with the expectation of successfully contradicting the proposition. At least we have never seen one of the class specified that could be designated by any less a forcible term. The results of the decomposition of retained food particles admixed with mucin, continuously plays the part of a predisposing cause of more deeply seated inflammations of those soft tissues with which portions of the bridge are in constant contact. These deep-seated cases of gingivitis by a process of continuity not infrequently assume alarming proportions. The following case came under the writer's observation in the spring of 1914. A man aged about sixty had been for at least ten years prior to our examination of his mouth the wearer of a number of pieces of bridge-work. He consulted us in regard to a severe type of inflammation of the soft tissues under a form of saddle bridge anchored to the lower cuspid and first bicuspid and supporting two artificial molars. The soft tissues which were markedly swollen and exquisitely painful would not respond to any such treatment as did not involve the removal of the piece. The patient was extremely toxic and his digestion had been, as he explained, very poor for many years. To this (the removal of the piece) the patient did not at first assent; and when he finally decided to avail himself of our advice he was then in the grip of a series of symptoms strongly simulating those of cerebrospinal meningitis. The patient eventually recovered but only after a siege of several weeks of confinement to his room under the care of two physicians and several nurses. His health has improved wonderfully, the gastric symptoms having disappeared. We doubt not that had he consented at the outset to rid his mouth of all the sources of constant irritation and infection, the seriousness of the situation would have been averted.

The last proposition upon which we must ask to focus your attention is the one which has to do with atrophic changes in the pericemental fibers following the fixation of the alveolo-dental articulation by bridge-work of the permanent type. The peridental membrane through the agency of its intra-alveolar fibers exhibits among many other functions that of enabling the tooth to have a certain degree of play in its socket, in the course of masticatory movements. In other words, in addition to acting as the retaining medium of the tooth in its alveolus, the fibers are almost constantly functionating, displaying that degree of elasticity, thanks to which the pulp is not jarred out of existence. The fixation of the joint brings about atrophic changes in these fibers which either completely disappear or become weak links in the chain of resistance to bacterial invasion. A fixed piece of bridge-work destroys the slight movement of a tooth in its socket. It first produces an ankylosis and eventually the atrophy of the affected fibers.

The cases here reported represent, in our judgment, the pathologic conditions usually found associated with both individual and assembled crowns. They do not represent exceptions taken from a long series of cases selected for the purpose of substantiating the statements herein advanced. They typify the conditions most frequently encountered in private and infirmary practice and the story they tell, a narrative of physical inability, mental anxiety and lost ambi-

tion, is precisely the purport of this message,—an appeal for any form of prosthetic dentistry which does not spell ultimate invalidism to those who through neglect of dental diseases have to avail themselves of it. Indirectly, please interpret our remarks as an urgent entreaty for the conservation of the dental pulp, not perhaps so much for the sake of maintaining the vitality of the dentin, but because its disappearance through disease or to subserve prosthetic purposes carries with it complications of so serious a nature as to warrant the statement that the loss of a pulp through any cause, marks a tragic epoch in the individual's existence.

REPORT OF A CASE OF DENTIGEROUS CYST OF THE MANDIBLE IN WHICH THE X-RAY PROVED OF GREAT VALUE

By E. F. Tholen, M.D., D.D.S., Los Angeles, Cal.

W. E. Age 16. Male.

History.—Two years ago noticed pain and swelling over center of lower jaw. This was incised through the mouth and drained. Pus obtained. Symptoms subsided after six days. Patient stated that radiograph made at that time showed nothing abnormal. The same condition has recurred twice. The lower centrals and laterals have always been sensitive and at times quite loose.

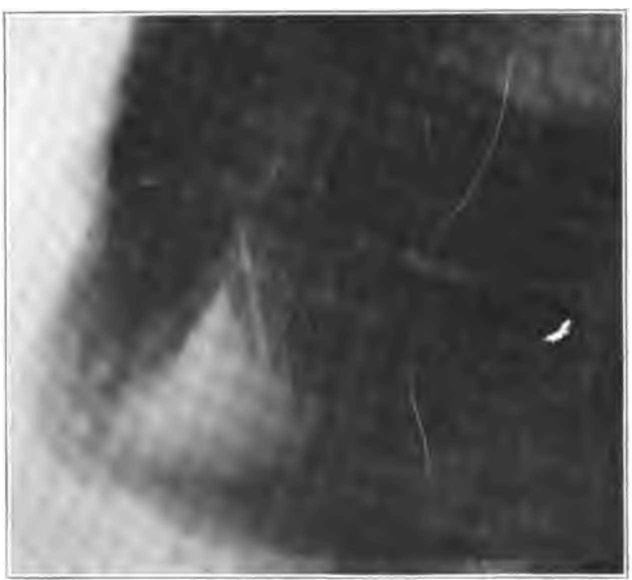

Fig. 1.—Radiograph showing the extent of the cyst on the left side of the median line.

The last attack began January 26, with pain, tenderness, temperature and swelling of anterior third of lower jaw. It was lanced through the mouth two days later, and an offensive pus obtained. Five days later I saw the patient. Ex-

amination showed bulging of the lingual plate of the mandible, crowding the tongue backwards and interfering with speech. There were no signs of an acute inflammation. The centrals and laterals were displaced foreward, quite loose, tender to pressure, and sensitive to cold. There was an incised wound in the labial fold that discharged a yellowish watery fluid. Probing wound led to normal bone. The soft tissues over the mental region were infiltrated. The external surface of the mandible appeared normal. Radiograph shows a cyst extending from bicuspid to bicuspid involving the entire thickness of the mandible from the alveolus to the lower border. The roots of the laterals and centrals were in the cyst. (See Figs. 1 and 2.)

Fig. 2.—The extent of the cyst on the right side of the median line is here shown.

Treatment.—The lower centrals and laterals were extracted and an incision made distally and lingually from sockets to the first bicuspids. The lingual mucoperiosteum was elevated and the underlying wall removed with chisel and biting forceps. The anterior wall of the cyst was left intact and made flush with surrounding mandible. The wound was packed. The patient made an excellent recovery.

Examination of the cyst wall showed it to be made up of dense connective tissue and lined by a layer of squamous epithelium which was infiltrated with small round cells.

CURRENT ORTHODONTIC LITERATURE

EDITED BY H. C. POLLOCK, D.D.S.

The Bodily Movement of Teeth in Orthodontia

IN a paper read before the European Orthodontia Society at its seventh annual meeting in Paris in August of 1914 (*Dental Cosmos,* July, 1916), Dr. Calvan S. Case, of Chicago, takes up in detail the question of the bodily movement of the teeth. Art in orthodontia, contour apparatus, the Angle apparatus, the history of the bodily movement of teeth, bone movement and interstitial development, bodily protrusion of the lower front teeth, bodily mesio-distal movement of the buccal teeth, and retention are each thoroughly discussed in this admirable essay. Cases are shown and illustrated in which the bodily movement of teeth are necessary and decidedly indicated. Dr. Case presents the final facial casts showing the artistic effects of bodily movement which has carried the alveolar and intermaxillary processes forward together with considerable development of bony structure, thereby correcting the facial lines, and contours of the upper lip and nose.

In regard to "Art in Orthodontia," Case says that "the highest aim in orthodontia has been to place the teeth of every patient in normal occlusion, accomplished mainly by an inclination of the crowns, and too frequently in cases which demanded a bodily movement. This has been done with the almost blind belief in the teaching that the developing forces would ultimately move the roots and alveolar processes, and even the entire facial outlines, to normal relations with the crowns, and that consequently the best possible results would be ultimately attained. It has taken a good many years of clinical experience and observation for the many to realize the futility of this teaching. Not but that it always will be, and should be, our highest aim to place the teeth in normal occlusion, when this can be accomplished without producing a facial deformity. But there is another side, in addition to the mechanical and physiologic usefulness and utility of the dentures, which has been growing and developing through the influence and the natural processes of our occupation. It is the artistic side of our temperaments, with its important relations to the practice of our specialty. To be sure, some possess this quality to a greater degree than others, yet no one could become an artist of any note without its cultivation and higher development. Orthodontia in its highest sense is art, and orthodontists who practice their specialty as they should are artists—and in one sense to a far higher degree than sculptors and painters; for their work is to bring harmony and beauty to living forms—to the human face, which has had more to do with the battles and emotions of life than any other one subject. Moreover, their field of labor is that area of the face in which lies its greatest attractiveness if perfect, but which may be a source of its greatest repulsion if imperfect."

"By this it will be seen that the art side of dental and dento-facial orthopedia is one of the most important basic factors of this specialty, because it not

only pertains to the appearance of the teeth in talking and laughing, their harmony of position, alignment, and occlusion, but it also imperatively relates to the facial outlines whose imperfections in repose and motion are marred c beautified by the underlying framework, told in the lights and shadows of facial contours. It is through a cultivation of the artistic side of our temperaments that an increasing desire awakens in us to accomplish the most pleasing results. It is this which is leading us to a closer observation and appreciation of the beautiful, and to a fuller realization of that well-established scientific truth, that nature does not 'start out with each individual to build according to a predetermined plan of harmony,' but builds exactly that which is forced upon her by the inexorable laws of heredity and variation. Moreover, it was the artistic desire to correct certain dento-facial deformities, and some of nature's inharmonies, which, over twenty years ago, was the mother of the idea of the principle of bodily movement of teeth. It matters not what methods are employed to verify the truth of this great principle and its artistic and physiologic accomplishments, whether it be by methods which have proved so successful in my hands and in the hands of others for the past twenty years, or by the more recent method introduced by Dr. Angle or by those of Dr. Jackson and others. What really counts is that a greater number of world's sufferers will be benefited, and the principles of dental and dento-facial orthopedia will have progressed."

In regard to the new Angle apparatus for the bodily movement of teeth, Dr. Case says "it would hardly become me to criticize it in any way—never as yet having employed it—but I expect to improve an early opportunity to try out the effectiveness of this spring torsion force. I am inclined to believe that no unprejudiced advanced orthodontist can ever have the slightest objection to the faithful trying of any method which is claimed to be successfully employed by others; nor will he refrain from taking advantage of every principle which seems to be along the lines of advancement, from whatever source. I do not mean that we will try the Angle apparatus as many have claimed that they have tried to construct and employ the contouring apparatus—possibly once—and found it wanting; just as they have tried to construct and apply our retaining appliances—once. Apparatus which demands real mechanical skill and a high order of judgment to construct and apply, cannot be truthfully judged as to its efficacy and use except through many trials. Appliances which seem to be the most complicated and difficult to construct are often found to be no more difficult than others, when one gets into the systematic run of their construction and employment; moreover, they are commonly the ones which require the least time and attention after being properly placed, and they usually produce the least pain and annoyance to patients.

"This is eminently true of the protruding contour apparatus. When once it is properly constructed and placed, the work goes forward to its completion surely and truly, with the least possible annoyance to everyone concerned. In fact, no apparatus that we employ occasions so little trouble from the beginning to the end, every move being perfectly under the control of the operator and mostly by the simple turning of two or more nuts. In the main, these sayings may be true of the Angle apparatus, though at the present writing

it has hardly had sufficient time or employment in extensive movements to establish its full clinical value from a scientific standpoint. I sincerely hope it will do all that is claimed for it, and that it will continue to occupy an important place in orthodontia. It certainly is far and away in advance of the expansion arch with its numberless wire ligatures and wire bands, and will be more so when clamp-bands are exchanged for sensible stationary anchorages with rootwise extensions. But I can very well understand how, if it is properly constructed and accurately adjusted, it will be effective in the correction of a large proportion of general minor cases, and perhaps in all cases for young children whose alveolar processes readily yield to comparatively mild continuous force. No one would believe, without experience, what can be accomplished with those light intermaxillary elastic rings."

For the more difficult operations, however, especially for those older than ten or twelve years of age, requiring extensive bodily movement in cases of decided retrusions and protrusions of the roots of front teeth, often accompanied with marked dento-facial deformities, no method, in my opinion, can ever equal the contouring apparatus, which is founded upon well-established principles of mechanics. It is therefore a great pleasure to me and to others who have witnessed the wonderful results of the extensive employment of this apparatus for so many years, that now, under the stimulating influence of this enthusiastic acceptance of the great principle of bodily movement of teeth, this apparatus is surely on its way to the hands of many skilled men who will be, and will *continue* to be, just as enthusiastic over its possibilities and results as we are.

In discussing the history of the bodily movement of teeth with this apparatus, Case says: "The first case in which these principles were applied was begun in the early part of 1892, and published with the completed case in a paper illustrated with facial and dental plaster casts, appliances, and drawings, read before the February, 1893, meeting of the Chicago Dental Society. It was in connection with this case that the *disto-mesial action of intermaxillary force* was first introduced. While the apparatus which was constructed for this case was very crude compared to subsequent ones, yet the success with which I was enabled to produce a bodily protruding movement of the upper front teeth and seemingly the entire intermaxillary process, even to straightening the nose, was hardly believable even by myself. In the discussion of the paper, Dr. G. V. Black, who seemed somewhat skeptical of the possibilities which the facial casts showed, was kind enough to laud the ingenuity and practicability of the intermaxillary force, and was the first man in the world to mention its probable disto-mesial action in adjusting the occlusion. If I remember rightly, he said that elastics placed in the manner shown on the mounted model exhibited would move the teeth of one jaw back and the teeth of the other jaw forward, and thus when necessary the dentures could be placed in normal occlusion. I regret that Dr. Black's remarks at that time were not published in full. While the action of the intermaxillary elastics was probably the main force which corrected the occlusion in this case, I employed it primarily to retrude the lower front teeth to proper occlusal positions after extracting the bicuspids, and to reinforce the stability of the upper anchorages; and immediately after this meeting, both Dr.

A. E. Matteson, of Chicago, and myself commenced the employment of these elastics for the disto-mesial adjustment of occlusion.

At the meeting of the International Congress in August, 1893, the above case, with two others which had been completed, was presented, fully illustrated and described. From that time up to the present the practicability of this principle of applying force for the bodily movement of teeth, verified by the remarkable artistic dento-facial results that were accomplished in numerous cases, has been presented before all the leading dental societies which have met in America, and once in this city at the International Congress of 1900."

"In a discussion of a paper which I read at Detroit in 1895, before the Tri-State Dental Society, and which was illustrated with many dental and facial casts, our beloved and lamented Dr. George H. Cushing made the following remarks: 'If there are any objections now to the possibility of moving the teeth *en phalanx* bodily they must fall before the positive evidence of clinical observation. Two of these cases I have seen under treatment from the first. I cannot begin to tell you the extent of the improvement in the facial expression. The maxillary bone and the process were so receded that there were depressions each side of the median line so deep you could lay your finger in them. Those are now very nearly two-thirds obliterated, I should think; and though this mask shows a wonderful improvement, it does not show fully the great change which has been effected.' "

In speaking of retention, Dr. Case has the following to say: "One of the most important, if not the most important branch of orthodontia, is permanent retention. This particularly applies to retention after a bodily movement of the front teeth. Moreover I wish to emphatically assert from the standpoint of an extensive experience that no movement of the teeth demands so great an amount of stability in the retainers as an extensive bodily movement of the front teeth, *en phalanx,* whether upper or lower. Nor is there any movement which demands that the retainers remain upon the teeth such a length of time. As the Angle apparatus was originally intended as a working retainer, there is no reason to think it will not retain the teeth it has moved. It will doubtless require great nicety of judgment to determine just how much force the spring arms must exert in order to prevent the roots from returning, and at the same time not to exert sufficient force to continue the regulating movement. The same is true of intermaxillary elastics when employed to aid retention. But as I understand that the Angle bow can be easily removed, the forces upon the different teeth can from time to time be readjusted according to their needs. That, however, is not the great objection to employing this apparatus for a retainer. It is the same objection that obtains in employing the contouring apparatus for a retainer. One is quite as conspicuous as the other, and this is a very great objection when one considers that, for patients more than eight or ten years of age, bodily labial movements of the front teeth should be retained at least two years. Nor does the objection stop here. Patients who have undergone the tedious operation of regulating, extending over a period of one to two years, during which time the teeth are at least brought to a position of perfect correction, would decidedly object, and especially the parents, if they were told that

they must continue to wear the contouring apparatus, or any other regulating apparatus, for the two years more.

"The retaining appliance which I have extensively and successfully employed for the last eighteen years is not much more unpleasantly conspicuous than the ordinary gold or platinum fillings between the front teeth, except the bands around the canines, which are now made quite narrow in front and fitted close to the gingival borders. This appliance is supplemented for bodily movement with rigidly attached lingual bars; or tubes for No. 17 iridio-platinum bars which extend to open tubes on the molars—the ends being threaded for nuts to act in the desired direction. When this appliance is cemented on the teeth, whose roots have been moved labially, the ends of the bars are raised to a position even with the occlusal surfaces of the molars, and as soon as the cement has hardened they are sprung gingivally into the open tubes, which are closed around them. It will be seen that this exerts a spring force upon the roots of the front teeth in the direction of their original movement, and which at any time can be increased with the curved bending pliers. For many bodily movements of the front teeth *en phalanx*, especially for children, I have for years advocated the employment of this apparatus for not only a working retainer, 'but one which could be made to exert a similar—though less powerful—force to that of the regular contour apparatus. Because of its inconspicuousness it may be preferably employed from the start in minor bodily protruding movements of the incisors. In all cases where it seems desirable to remove the regulating apparatus before the full completion of its work, this character of retainer will be found invaluable for holding the position gained, and for continuing the movement.' I cannot see why it cannot be made to exert fully as much force, and of quite the same character, as the Angle apparatus. It certainly would have the very great advantage of inconspicuousness.

"There has recently arisen a cry against the stationary method of retention, claiming that it debars development, bone-growth, etc. It is of the same source and character as objections which debarred for so many years the general acceptance of bodily movement. *That* came from men who had never had any experience in bodily movements, just as this objection now comes from men who have had absolutely no experience whatever in this method of retention. Is it possible that an extensive and practical experience of nearly twenty years, during which time almost every case regulated by myself and others has been retained in this way, shall count for nothing against visionary theories backed up by no practical knowledge or experience? I defy any man to point out a single case of mine to others which has worn the six-band stationary retainers that were properly constructed and taken care of for two years or more, which has suffered the slightest deleterious effects, or any indication of an inhibition of development, etc. On the contrary, this method of retention has given the very highest satisfaction to everyone concerned. As I said as long as ten years ago: 'If I were deprived of its benefits I would quit the practice of orthodontia.' Moreover, in regard to the theoretic objections to its holding the teeth immovably, let me say that it would be *impossible* to hold teeth absolutely still with any appliance, though they might not perceptibly move in their relations to each other. The forces of mastication while in action would keep up a constant move-

ment of the roots in their sockets. There is only one drawback to its general employment, and that is: It demands the most exacting mechanical workmanship and good judgment for its proper construction. No more, however, if as much, as the recent Angle apparatus. Nor should that requisite be considered a valid objection to the employment of either of these appliances, nor of anything else in dentistry which skillful men successfully construct and employ, and which enables them to attain a desired object."

Further Evidence as to the Influence of the Forces of Occlusion in the Development of the Bones of the Skull

THIS subject is discussed by Lawrence W. Baker (*Items of Interest,* July, 1916), being a continuation of former work done by this writer in which he has shown the tremendous influence exerted by occlusal forces upon the development of the skull. The experiments were conducted in the Research Department of the Harvard Dental School. Regarding the experiments, Baker says:

"The experiments on which this paper is based and those which I have at present under way make me believe that the reaction of these occlusal forces on the skull are based on as definite laws as are the forces of occlusion themselves; furthermore, I believe that in these reactions are locked the secrets of a normal skull; for if a group of forces acts in accordance with the body laws, why should not the reaction of these forces be governed by just as definite laws as are the forces themselves. . . . . There are several other matters worthy of consideration; for example, note the area of this muscular mass (including the tongue), as compared with the whole head. It will be observed that it ranks well in size with the other structures or organs of this most compact, intricate and wonderful part of the human body. It is evident to me that Nature never would have devoted so much important space to this group of muscles if it were not for the benefit of the head as a whole. According to the laws of evolution, the functional activity of such a mass of muscular tissue cannot but have a direct and powerful influence in shaping the bones to which they are attached. Furthermore, the great supply of pure blood that the vigorous activity of these muscles demands not only rushes to these muscles, but also to other parts of the head, and it seems no more than logical to believe that the brain itself shares in this increased blood supply. The idea of muscular activity and increased circulation to the adjacent parts is a well-known fact. Dr. Campbell, in his remarkable series of papers laid great emphasis on this matter."

"It occurred to me that if my hypotheses regarding the influence of the dental equipment on the formation of the bones of the head were correct, interference with the laws of occlusion in the lower animals would show consequent effects in the formation of the bones of the skull; and if variation occurred it might throw some light on the most complex problem of the development of the human head."

To test this theory, the following experiment was performed: A litter of four rabbits was selected at the age of weaning. One of the rabbits was chloroformed, and the skull procured shows considerable deviation as a result of the

lost occlusion on one side. Dr. Baker shows many deviations of the skull taken at various ages as a result of the occlusion having been destroyed.

In experiments of the same character upon sheep, animals of the same birth were selected for the test. The same procedure was employed as in the case of the rabbits and after seven months the skulls were procured. Not only was the growth of the skull distorted in the lateral plane, but there was vertical distortion as well. There were other experiments upon dogs.

In conclusion, Dr. Baker states that, although he has been working at this problem for a number of years, it has progressed very slowly, due largely to the fact that each experiment extends over so long a period of time, and also because it is a very difficult matter to completely eliminate the functions from one lateral half of the dental apparatus. The persistency with which Nature adapts the occlusion of the interfered-with teeth for use is remarkable and strongly points out the importance of the dental apparatus in the scheme of life. He fully realizes that a hostile observer could criticize this work, as far as he has carried it, as being incomplete; but those who are familiar with the biology of bone growth and who appreciate that muscular activity, blood supply and cellular activity are all bound together in bone development, will appreciate the significance of this line of investigation, and will perceive its importance in the development of the bones of the head and the organs incased therein. The fact that his investigations are perhaps another reason for making the general practitioner appreciate the far-reaching influence of preserving the temporary dentition which serves during the important development period of childhood; and also that orthodontists are referring to it as a plea for the establishment of the occlusal equilibrium early in life, stimulates him to carry still further this slow and patient work.

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EDITORIALS

Referring Patients

THE ethical phase of referring patients in the practice of orthodontia as a specialty, is one which has many sides and which requires considerable attention, both from the general practitioner and the orthodontist. It is also an important question in the relation between the orthodontist and the rhinologist. Those engaged in the practice of orthodontia realize that their patients are referred to them from three sources. In the beginning the majority of patients are sent to the specialist by the general practitioner of dentistry and in a few cases by the general practitioner of medicine. In later years if the practitioner of orthodontia has been successful, a large number of his patients are referred to him by his former patients.

We have already discussed in an earlier issue the responsibility assumed in regard to referring cases which involve a financial consideration; in this editorial, it is not our intention to again dwell upon the commission but upon the ethical side of the moral obligation assumed by the parties involved in this transaction.

It is also necessary to take into consideration the education of the patient which necessarily must be done to a certain extent by the man who refers the case. In dealing with referred cases, we find that there is a vast difference in the attitude of the patients that are sent to orthodontists by some men and those that are sent by others. All cases that are referred to the orthodontist by the profession are necessarily seen first by someone engaged in the practice of dentistry or medicine. It is a lamentable fact that a large number of malocclusions that require treatment from every standpoint are never referred for treatment. The reason of this is probably due to the fact that many practitioners of dentistry do not recognize malocclusion when they have the patient in the chair, or if they do recognize this condition, do not assume any responsibility towards the welfare of the patient, and consequently the case is never referred. We know of several instances where practitioners of dentistry have taken the attitude that, if they are not treating malocclusions, they are not going to look for them; neither are they going to refer them to any particular man. If their patients should ask them regarding the treatment of malocclusion, they state in an offhand way that the malocclusion could probably be corrected, and if asked for advise as to whom to go, will probably name all the men practicing orthodontia in the community and let the patients take their choice. While the general practitioners of dentistry may think that is very fair to the patient and to the practitioners of orthodontia, it nevertheless creates an attitude in the patient's mind which is very objectionable and which often results in a great deal of evil and may result in the case not being treated at all.

In the first place, in order to successfully refer a case of malocclusion to an orthodontist, the dentist must at least know enough about the subject so that he can recognize the malocclusion and be able to present the necessary treatment to the patient in such a manner that the patient will realize that something must be done. To simply tell a patient that he has a malocclusion and that it should be treated, and that he had better go to such and such a man, is the sort of reference which practically accomplishes nothing. If the patient is not already interested in the subject nothing will be accomplished. Therefore in order for a case to be successfully referred, the general practitioner must necessarily instill into the mind of the patient the necessity of having the work done, the evils which will result if not done, and the benefits which will occur if it is done. A patient referred with that kind of an argument comes to the orthodontist prepared to have the case treated, and is not coming out of mere curiosity which is often true in a great many instances. Furthermore, the case should be referred to some particular orthodontist and the practitioner of dentistry should have faith enough in that orthodontist so that he can tell the patient he believes the man can successfully treat the case, and is the individual by whom he wants the case treated. In that manner the dentist assumes a certain amount of responsibility and the patient feels obligated to go to that particular orthodontist and have the case treated. Of course, with that kind of a reference the general practitioner of dentistry must know the orthodontist sufficiently well to believe that he can treat the case successfully, so that the patient will have no chance to criticize the dentist for referring him to a man who was incompetent. Also when properly referred, the patient goes directly to the man referred to with the idea of having the work done.

He has definitely made up his mind, or has been definitely informed as to who should do the work, and consequently, as a rule, follows out the instructions given

by the dentist. On the other hand, if the general practitioner of dentistry simply states that the malocclusion should be treated and names four or five men who are doing that class of work, the patient is soon bewildered in regard to selecting an orthodontist; consequently he has an indifferent attitude, and probably visits all of the men trying to find out which one will do the work the cheapest. The patient is, therefore, placed in the attitude of a shopper, and simply goes from one place to another without any definite idea of what he wants, or who he wants to do his work. In a great many instances of this kind, he finally ends up by not having it done at all, because he has never been properly impressed by the general practitioner of dentistry that something should be done by someone along a definite line. It would therefore be much better for the general public, and everybody concerned, if cases were referred to some one particular man, and the patient impressed that that particular man is the one to do the work. Then the creation of a shopper would be avoided and the patient would feel responsible to his dentist, to a certain extent, and go to the man he recommended.

There is no question but what there is a close relationship existing between the work of orthodontists and rhinologists, and as a result, there is the same question in regard to referring cases from the orthodontist to the rhinologist, or from the rhinologist to the orthodontist, as exists between the general practitioner and the orthodontist. It is a well known fact that there are a great many cases of nose and throat conditions which can not be successfully treated from the standpoint of the patient unless they are treated in conjunction with orthodontic work. This fact is known and realized by a large number of rhinologists, nevertheless many of these rhinologists do not send such patients to orthodontists for treatment. The reason for that is not because the rhinologist has not realized the benefit of orthodontic treatment, but because he does not assume the responsibility in referring the patient to the orthodontist. We know of rhinologists who realize fully the importance of orthodontic treatment, but who, nevertheless, allow their patients to go without such treatment because of the improper manner in which they give advice.

The recommendation for orthodontic services is generally made by the rhinologist saying to the patient that he "should go to see Dr. So and So in regard to his teeth," or in other words, that his "teeth are irregular and should have attention." This advice is usually given when the patient and the parent still have fresh in their memory the operation for adenoids and tonsils, and consequently they are in no state to receive information that something else should be done which necessarily would involve considerable time and expense. If the matter was presented to them in the proper light, so that they were made to realize the benefits of orthodontic treatment after the operation was done on the nose and throat, they would then be willing to have the case carried to completion by having the proper orthodontic services rendered so that the individual could be a proper breather. It is one matter to refer patients to an orthodontist and another to refer them in such a manner that they will go and have the proper services rendered. We therefore believe that in all questions of referring patients more time should be spent to impress upon the patient's mind the necessity of the operation so that he will abide by the advice given by the physician or general practitioner.

The Value of Orthodontic Treatment

THE patient seeks the services of the orthodontist for several reasons. Probably the majority desire the correction of malocclusion for the improvement that will be produced from the esthetic standpoint. In fact, only a few years ago the strongest talking point for the correction of malocclusion was the effect it would have on the facial outline. There is no question but that such malocclusions as mesioclusions and distoclusions produce great facial deformities and the patient is justified in seeking relief from that deformity. However, the results that are obtained from the correction of the facial deformity are only secondary to other benefits that will be derived when the teeth are placed in their proper positions so that the patient can properly masticate his food.

In an article by Dr. O. A. Weiss, which appeared in the June issue of the *International Journal of Orthodontia,* he gives several reason why malocclusions should be treated. There need be little argument made to the patient in regard to the correction of extreme cases of mesioclusion and distoclusion, for those deformities are very apparent. However, there are a number of other cases of malocclusion which do not produce such extreme facial deformities, but which destroy the masticating efficiency of the teeth, and therefore render treatment necessary. There is also a certain class of malocclusion in which the patient is not aware of the serious condition existing, which produce great harm to the teeth and surrounding structures, and the treatment of which would render a great service to the patient. It is very difficult to impress upon these patients the value of orthodontic services. It is a recognized fact that cases of mesioclusion are generally progressive, but it is also a fact that all types of malocclusion are progressive up to that point where the teeth become locked in positions of malocclusion. Consequently neutroclusion cases demand treatment to prevent them from becoming worse. Complicated with these cases of malocclusion are conditions which effect the proximal contact of the tooth and make it impossible for the teeth to be self cleansing, therefore producing pathological conditions which may develop later in life. In fact, the majority of teeth in malocclusion produce a number of dental ills which will effect the patient through life, and which can only be corrected, or prohibited, by having the teeth placed in their proper positions. It is often impossible to make the patient realize the necessity of treatment if the malocclusion does not cause an extreme facial deformity. We have seen cases of malocclusion which were a decided detriment to the patient, the teeth being in such a position that it was possible to predict a number of conditions which would arise in later years.

One example of such cases is an excessive overbite of the upper and lower incisors, produced by infraversion of the molars, which would be a very serious condition if allowed to go until the patient became an adult. As there is very little facial deformity in these cases, and as it requires a great length of time to correct them, it becomes necessary to impress upon the patient the value of the treatment in years to come, rather than the value of the treatment at the present.

It therefore becomes necessary that we educate our patients that the greatest value of orthodontic treatment lies not in the esthetic side, but is to be derived from benefits which occur when the teeth are placed in normal occlusion, thereby eliminating a great many dental ills to which malocclusion is a predisposing cause.

Sixteenth Annual Meeting of the American Society of Orthodontists

THE Pittsburgh meeting of the American Society of Orthodontists, July 20, 21, and 22, proved to be one of the very best ever held by this society. The attendance was large—between seventy and seventy-five. The papers presented showed careful preparation on the part of the essayists and their discussion was spirited and thorough.

The president, Dr. Frederick C. Kemple, left nothing undone that would add to the success of the meeting. Dr. M. N. Federspiel, of Milwaukee, was elected president, and Drs. F. C. Kemple and Ralph Waldron to the Board of Censors. Excelsior Springs, Mo., was chosen as the place for the 1917 meeting, which will be the first week in September. Thirty-nine new applicants were proposed for membership.

The New President of the American Society of Orthodontists

DR. M. N. FEDERSPIEL, of Milwaukee, Wisconsin, was elected President of tne American Society of Orthodontists at the Pittsburgh meeting.

Dr. Federspiel was born in Lincoln, Wisconsin, September 15, 1879, the son of Peter and Catherine Federspiel. He graduated from the Dental Department of the Milwaukee Medical School in 1900, and in 1902 from the Angle School of Orthodontia. In 1910 he completed a four year course in the Medical Department of the Marquette University in Milwaukee, and in 1911 was made Professor of Oral Surgery in the Dental Department of this school, which position he still holds. He is at present also a member of the Faculty of the Dewey School of Orthodontia. He is a fellow of the American Medical Association, member of the Wisconsin Surgical Society, Milwaukee Medical Society, and Wisconsin State Dental Society and National Dental Association. At the present time he is President of the Milwaukee County Dental Society.

To The Editor:

In a recent issue of your journal you published an article for me entitled "Orthodontic Engineering." In this paper reference was made to a publication presented at the International Congress the year previous. The reader was referred to this paper which was jointly written by myself and Mr. Rudolph Hanau. As some confusion has arisen in regard to the dental surveying apparatus, I wish you would publish this letter stating that Mr. Hanau is the inventor of the mapping instrument. Mr. Hanau is also the originator of the mathematical method of determining the arch. The design of the arch illustrated in the article was accomplished by means of the occlusograph, an invention of Mr. Gilbert Dudley Fish, a civil engineer. Sincerely, F. L. Stanton.

PROGRAM OF THE SIXTEENTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF ORTHODONTISTS

(*Held at Pittsburgh, July* 20-22, 1916.)

THURSDAY MORNING.

9.00 *Meeting of Board of Censors.*

10.00 *President's Address,* FREDERICK C. KEMPLE, D.D.S., New York City; *Discussion opened by* FRANK M. CASTO, D.D.S., Cleveland, Ohio, WALTER H. ELLIS, D.D.S., Buffalo, N. Y.

11.00 *Report of Board of Censors.*

11.30 *Habits—Restoration of Functional Activity and Growth of Soft Tissues Involved in Orthodontic Treatment,* O. W. WHITE, D.D.S., Detroit, Mich., *Discussion opened by* BURT ABELL, D.D.S., Toledo, Ohio, GLENN F. BOWMAN, D.D.S., Pittsburgh, Pa.

THURSDAY AFTERNOON.

2.00 *Control of the Overbite in the Treatment of Class II Cases,* HERBERT A. PULLEN, D.M.D., Buffalo, N. Y. *Discussion opened by* ALFRED P. RODGERS, D.D.S., Boston, Mass., LLOYD S. LOURIE, D.D.S., Chicago, Ill.

3.30 *The Development of the Alveolar Process, Illustrated with Original Micro-Photographs,* MARTIN DEWEY, M.D., D.D.S., Kansas City, Mo. *Discussion opened by* M. N. FEDERSPIEL, M.D., D.D.S., Milwaukee, Wis., RICHARD SUMMA, D.D.S., Iowa City.

THURSDAY EVENING. (Union Meeting.)

The American Academy of Oral Prophylaxis and Periodontology.

8.00 *Practical Means of Preventive Dentistry for the Orthodontist,* GRACE ROGERS SPALDING, D.D.S., Detroit, Mich. *Discussion opened by* R. OTTOLENGUI, M.D.S., D.D.S., LL.D., New York City, D. WILLARD FLINT, D.D.S., Pittsburgh, Pa.

Changes in Pericementum Caused by Chronic Inflammation, F. B. NOYES, D.D.S., M.D., Chicago, Ill. *Discussion opened by* A. E. WEBSTER, D.D.S., Toronto, Can., RUSSELL W. BUNTING, D.D.S., Ann Arbor, Mich.

FRIDAY MORNING.

9.00 *The Development of the Bones of the Face,* WARREN B. DAVIS, M.D., Philadelphia, Pa. *Discussion opened by* MATTHEW H. CRYER, M.D., Philadelphia, Pa., LAWRENCE W. BAKER, D.D.S., Boston, Mass.

10.30 *The Effect of Heat Treatment of Metals Used in the Construction of Orthodontic Appliances,* FRANK A. FAHRENWALD, Cleveland, Ohio. *Discussion opened by* N. S. HOFF, D.D.S., Ann Arbor, Mich., JOHN V. MERSHON, D.D.S., Philadelphia, Pa.

11.30 *Illustrated Talk on the Comparisons Between Ancient and Modern Teeth and Skulls,* M. H. CRYER, M.D., D.D.S., Philadelphia, Pa.

FRIDAY AFTERNOON.

2.00 *The Advantage of Plain Bands on Molars and the Technic of their Construction,* CHARLES A. HAWLEY, D.D.S., Washington, D. C. *Discussion opened by* J. LOWE YOUNG, D.D.S., New York City, J. A. BURRILL, D.D.S., Chicago, Ill.

3.00 *The Records of an Orthodontist,* B. E. LISCHER, D.D.S., St. Louis, Mo. *Discussion opened by* C. R. JACKSON, D.D.S., Indianapolis, Ind., C. W. B. WHEELER, D.D.S., New York City.

4.00 *Recent Progress in Rhinology of Interest to the Orthodontist,* ALLEN H. SUGGETT, D.D.S., San Francisco, Cal. *Discussion opened by* JAMES D. MCCOY, D.D.S., Los Angeles, Cal., B. E. LISCHER, D.M.D., St. Louis, Mo.

SATURDAY MORNING.

9.00 *Important Prenatal Factors Influencing the Development of the Facial Area and Causing Malrelation of the Arches at Birth,* B. W. WEINBERGER, D.D.S., New York City. *Discussion opened by* E. A. BOGUE, M.D., D.D.S., New York City, L. P. BETHEL, D.D.S., Columbus, Ohio.

10.00 *Clinics were given by* DRS. F. C. KEMPLE, M. N. FEDERSPIEL, F. M. CASTO, D. W. FLINT, B. E. LISCHER, R. OTTOLENGUI, B. W. WEINBERGER, JOHN V. MERSHON, RAY D. ROBINSON, JOS. E. JOHNSON, W. G. BARR, W. A. MCCARTER, R. C. WILLETT, W. B. DALTON, GRAFTON MUNROE, V. H. JACKSON, O. W. WHITE, A. KINGSBURY, CARL B. CASE, WALTER H. ELLIS, C. W. B. WHEELER, CHEVALIER JACKSON AND GEO. JOHNSON.

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ORIGINAL ARTICLES

DENTAL ENGINEERING

BY RUDOLPH L. HANAU, NEW YORK CITY.

IN my introduction to the dental profession, I adopted the designation "Consulting Dental Engineer," implying thereby, that I had enlisted in a consulting capacity to the profession in meeting and solving the intricate problems of orthodontia.

Before I ever thought of dentistry, my time was largely occupied in solving such problems as other men in my profession did not care to attempt, i.e., I specialized in solving extraordinary and unusual problems.

I was consulted by Dr. F. L. Stanton to design a device for outlining a denture, a device which should prove more efficient than the method of employing the compass, as had been his custom before. The resulting method was given in a joint paper by Dr. F. L. Stanton and myself read in San Francisco before the Panama-Pacific Dental Congress in 1915. In the same paper the apparatus which I constructed is described. During my association with Dr. Stanton he taught me the laws of occlusion, the sequence in the eruption of the teeth, and many other things pertaining to orthodontia; the last word, I will confess, had not, previously, been included in my vocabulary.

In the course of my investigations, my attention was called to a paper by Dr. Hawley on the "Dental Arch." After diligent study of the treatise, in which a brilliant attempt is made to classify or standardize the dental arch, I immediately became dubious, whether the hypothesis warranted any such attempt inasmuch as hardly two dentures were found to be alike,—either as a whole, respectively, or in their respective subunits.

After I understood the axiomatic laws pertaining to occlusion, there was no doubt in my mind that it was erroneous to assume that various dentures could be represented by similar geometrical figures, and it also nonplused me that these geometrical figures should consist of an arc of a circle and two straight lines, which, mathematically speaking, would mean that there were two points in the figure where the character of the curvature suddenly changes.

Dr. Stanton showed me several dentures but I could never recognize the arc of a circle and two straight lines, although in some dentures a curve of asymptotic character could be observed where the straight line was supposed to be. There was another feature totally neglected in the laying out of the dental arch as it had been presented to me by Dr. Stanton: Although the Curve of Spee was pointed out to me, it had not been considered in the delineation of the arch form. In other words: the dental experimenters laying out the arch, were plotting in two dimensions only, while there were actually three to be considered. I recognized that here was an untrodden field in science, complicated in its nature, but for that reason all the more interesting. I trust that my criticism will be appreciated as no efforts to minimize the value of existing methods, but as a frank differentiation between what is wrong and right. An engineering problem, such as the plotting of the dental arch presents, requires a thorough knowledge of descriptive geometry, kinematics and mechanics; it cannot, therefore, be reasonably expected to be solved,—truly solved,—by experimenters who lack the necessary training.

The writer, as already intimated, would, in all likelihood never have undertaken his researches relating to the denture, had not his attention, through a chain of circumstances, been focused upon the lack of understanding on the part of those who pretended to understand and others who swallowed the cookery at hand.

The denture, as a mechanism, is a very awkward and inefficient machine. The supervising engineer in a modern shop would never permit such an apparatus to "pass the gate." He would relegate it to the upper shelf of the model room, somewhere near the perpetual motion devices and locomotive model which is provided with legs instead of wheels as locomotion implements.

But, inasmuch as homo sapiens will not—in the near future—be called upon to supplant the said inefficient and awkward apparatus, named the dental apparatus, with a more perfect mechanical device, we may just as well console ourselves with the discovery that the denture is one of the most important parts of our organism and has highly ornamental properties, provided it is in fairly good condition.

Where scientific bases are lacking, esthetics are impressed to fill the gap. Often we are advised that artistic judgment (artistic prejudice is a better term) is to govern our endeavors to attain what might prove to be correct. It follows that guess work is employed, instead of cold scientific reasoning, and that in a measure is controlled by the inclination, skill, or the routine habits of the guesser. The employment of this pseudo-analysis makes it easily possible that through the respective influences of climate, altitude, whim or weather, or any of a hundred conditions, one and the same individual,—searcher after truth,—will come to various conflicting refutations of the same problem. All conclusions would of course be equally incorrect; it but devolves upon the scientist to view the accomplishment through an animated kaleidoscope. Dentistry cannot claim a monopoly of the conditions here exposed; such or similar conditions prevail also in most other professions,—probably in all.

The pseudo-scientific results which we so often lightly take for granted, are directly caused by the natural static inertia of the human mind.

When guess work has been pursued sufficiently long we like to call it "good judgment," when it has been recorded we all like to call it "science," and when we have finally committed it to memory we call it "experience."

The scientist will not always be able to distinguish between the theoretical and practical value of his study, but he will always endeavor to evolve applicable, exact methods because he knows that every intelligent, practical man will gladly substitute precise and logically correct methods for empiricism and "rule of thumb" methods. Practice will automatically eliminate the unessentials. In this spirit "Dental Engineering" is presented to the dental profession.

Dental engineering is the branch of theoretical engineering that has allied itself with practical orthodontia. It will and should give orthodontia the preciseness of investigation and accuracy of interpreting results that modern engineering possesses. It should widen the field extensively and invite and command the interest of true scientific men.

An article published by my former collaborator, Dr. F. L. Stanton, in the *International Journal of Orthodontia* (Vol. II, No. 5), and also papers read by others whom I have interested in dental engineering, convince me that the work that I have initiated, and am pursuing, has already aroused the interest of and demonstrated its usefulness to the dental profession.

In a paper read before the American Society of Orthodontists, at Pittsburg, July 21st, 1916, many of my findings are recorded, and they will be published by the society. From time to time I intend to present further results of my investigations, and, if they are found worthy by the editor of this Journal, they will, probably, be brought directly before its readers.

I seek and invite the co-operation of dental men, for only with their assistance will I, as an engineer, be able to attain results in this new field, which I am confident will justify its existence.

RETENTION

By Frank R. Woods, D.D.S.

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PART II.

In a former article was discussed certain general considerations in retention, and it is my purpose to continue this a little further before going into the intimate details of construction and application of appliances.

The forces of occlusion and malocclusion are identical and the resultant structures are in the one case, a harmonious development, and in the other, inharmony and confusion, only because we have in the first a proper balance of these forces in direction and degree, and in the second, a lack of it.

Now during the retention period these forces of occlusion are, of course, our very light and hope of success, but, owing to the fact that they are now active under a new set of conditions, which, inasmuch as they are the result of a relatively

rapid mechanical stimulation, are entirely artificial in character and more or less altered in degree, and these forces will have somewhat different values, perhaps, than we are wont to ascribe to them in the process of erupting a normal dentition.

In order to better understand their action we will enumerate the ones we consider most active in the changes accomplished during retention. They are, Cell Metabolism, Action of Occlusal Inclined Planes, Muscular Pressure, Normal Proximal Contact, and Harmony in the Size of the Arches. These forces have long been recognized by writers in orthodontia. I think there may well be added to the above the term, Temperamental Energy, as being a descriptive term which may be applied to the individual in a somewhat comprehensive way. As applied in an orthodontic connection it embraces, in essence or in consequence, a combination of cell metabolism, muscular activity, and influence of occlusal inclined planes. It includes cell metabolism because the metabolic activity of every cell interacts to produce the general physical and nervous tone of the individual, and the metabolic rate or pressure is in turn sustained and stimulated by this general temperamental energy or activity.

The concrete or clinical manifestations of this force are exemplified in the general bearing of the patient. The individual in whom this factor is high, will be alert; his every motion will be purposeful and decisive. When his jaws are in the position of rest, the teeth are not only in contact, but the muscles by which the jaws are closed are under a positive tension, and metabolic processes are mechanically stimulated to a distinctly greater degree than is the case in the absence of this stimulus.

It is but another exemplification of the law that growth and development are promoted by active function. In such an individual the upbuilding of related hard and soft structures of the face will progress prosperously, and, the degree to which this development is necessary to bring about harmony with the realigned arch, being considered, it will be accomplished in a minimum time. It will, moreover, give the greatest possible prospect of permanency, because the forces which have induced it have been the temperamental energy of permanent active muscular and nervous habit.

We have, of course, assumed that the general health of the patient is unimpaired by disease.

We shall now consider clinically the reverse of this type. Where our first type has been the very personification of energy and activity, the second portrays lassitude, indecision, and inactivity. The facial lines and angles are indeterminate and loose. The teeth with the jaws in the positon of rest are not quite in contact, and the muscles which accomplish the closure of the jaws, together with the orbicularis oris and its attached associated muscles, are under no habitual tension, but are flabby and show a fatty interspersion or possible degeneration. There is a lack of any constant mechanical stimulus to the circulation and consequently to cell metabolism. Here is exemplified the negative result through the same law of development according to degree of activity of function as that under which our first type experienced such a happy result. Development occurring in this case is likely to be slow, the tone of the new tissue lower, and its prospective permanency less certain. I do not mean that tooth movement will necessarily be difficult. In fact, the reverse is the usual experience, but, having been moved, there is a ready tendency to return to positions of malocclusion, which, I believe, is much

greater than in cases of the positive, first type. This type will be often met in its extreme form in Class II, Division 1, cases. Much of the difficulty of retention of these cases is due to these subnormally functioning facial muscles. In treating this type, only endless patience and double vigilance will avail. Retention can be proved sufficient only by years of care and months of waiting after removing each part, for the whole organization lacks the metabolic and functional tone which makes for permanency in orthodontic correction.

(To be continued.)

A PECULIAR ACCIDENT

By Frederick S. McKay, D.D.S., Colorado Springs, Colo.

The case with which this short article deals, was the victim of such a peculiar accident, if such it could be called, or to express it in better terms, so peculiar an experience, that it has been deemed worthy of description.

The lad of about nine years of age had been raised with difficulty and was in every sense of the term undeveloped which was in no way more conspicuously evident than in the dental arches.

It was a matter of apprehension to his parents and physician that the function of mastication was almost suspended, for as expressed by them it was "too queer to see him eat."

Judging from the occlusion it is evident that most of the masticatory func-

Fig. 1.

tion was performed upon the right side (Fig. 1), either because of the shortening of the vertical height of the arches on the left which allowed the cusps of the upper molars to close almost onto the gingival margins of the lowers, or else because of the tumefied condition of the gums on that side, which rendered mastication uncomfortable if not actually painful (Fig. 2, A and B).

The probabilities are that there were two distinct causes as above outlined, each sufficient in itself and yet intensifying each other.

When the case was first seen it was evident that the condition of the gums upon the left side was due to the presence of subgingival calcular deposits, plainly visible, upon the temporary molars, and more and more am I becoming impressed.

after continued observation, that, as a rule, orthodontists fail to recognize gingival irritations before commencing treatment.

From the present standpoint in viewing the significance of these early gingival irritations, it can be considered as nothing short of reprehensible to proceed with the placing of appliances without first planing smooth the rough etched surface of the enamel just under the gums and in the interproximal spaces, with the well-known planes which are available for this purpose, or referring the patient into the proper hands for such service.

The criticisms of the general practitioner regarding the irritation of orthodontia appliances have been well merited, and in my estimation these irritations

Fig. 2-A.

Fig. 2-B.

Fig. 3.

Fig. 4.

have been largely due to failure to properly administer this subgingival treatment.

To proceed, however, with the story; the treatment for enlargement of the dental arches was carried on during the winter and spring months and retainers were placed just before the boy was taken to a mountain resort for the summer.

During an exhibition the lad fell off a grandstand and both permanent upper central incisors were knocked out of the mouth onto the ground.

They were picked up and the boy taken to the dentist in the little mountain town who cleansed the dislodged teeth, opened the pulp canals, removed the contents, and filled the canals, and then reinserted the teeth into the sockets and ligated them to the retainer.

In replanting the teeth, however, in some unexplainable way they were transposed, the left one being put into the socket of the right side and vice versa, and I saw him about two weeks after the accident they had become quite firm, so that their transferal to proper position was deemed unwise. Fig. 3 shows the case as it was originally. Fig. 4 shows the present appearance, and there they must remain for how long we don't know, but the history of such cases seems to be that their loss will eventually occur through absorption of the roots.

THE PRINCIPLES OF ANCHORAGE

By Martin Dewey, D.D.S., M.D., Kansas City, Mo.

Professor of Dental Anatomy and Orthodontia, Kansas City Dental College; President of The Dewey School of Orthodontia.

PROBABLY no division of orthodontia requires as much attention or has been responsible for so many failures as anchorage. Only during the last few years have practitioners of orthodontia reached a point where they have been able to classify anchorage according to certain principles and always have some definite idea in view in the construction of the appliance, so as to follow out fundamental laws. In the movement of the malposed teeth, the most important thing to consider in the beginning is the question of anchorage. Angle states, "The movement of one or more teeth in any of the several directions is possible only by the exercising of force and its intelligent application in accordance with the laws of the mechanics and dynamics. . . . According to the well-known laws of physics, action and reaction are equal and opposite, hence it must follow that the resistance of the anchorage must be greater than that offered by the tooth to be moved, otherwise there will be displacement of the anchorage and failure in the movement of the teeth to the extent, or, probably, in the direction desired." Guilford[1] also states that, "The use of force for overcoming resistance and causing malposed teeth to assume their proper position falls within the domain of that branch of physics known as dynamic. . . . The movement of the teeth like the movement of other bodies is regulated and controlled by certain general principles or laws, the proper understanding of such of them as are important to us in our work is necessary in order that the required operation may be performed intelligently and in a scientific manner." It is therefore seen that the writers recognized that anchorage had to deal with certain mechanical forces which are recognized in other branches of mechanics. Angle and Guilford both refer to the old physical law, namely, action and reaction are always equal and opposite. In other words, just as much force as is exerted on the malposed tooth must be overcome by the anchorage.

If we had an unlimited field to work in or could make conditions or construct our anchorage according to our desires there would not be so many difficulties encountered in the movement of malposed teeth. However some of the difficulties which we have to encounter are summed up again by Guilford in which he says: "To construct a machine which by its action will accomplish a desired result may be easy, but to devise one that will give us the best results,

[1]Guilford: Orthodontia, 4th edition.

without waste of energy or an imposing ill-result requires familiarity with the principles upon which it is to operate and the attendant conditions which may limit or control its action." The last two parts of the quotation refer more particularly to the difficulties which we have to master in the treatment of malposed teeth, namely, we must be familiar with the principles upon which the appliances operate and in addition to that we must be familiar with the structure upon which we are going to operate or anatomic surroundings which make the obtaining of our anchorage difficult or impossible. Lastly Guilford mentions, "The attendant conditions which may limit or control its action." This is especially true in a case of a regulating appliance which must be confined within the oral cavity and must be so constructed as not to cause a great amount of pain or inconvenience. In other words, our space is limited and the objects upon which we are compelled to operate in securing the anchorage have already been arranged for us. If we had an unlimited amount of space and could attach to some object which would absorb an unlimited amount of force, a great many of the problems which confront us in orthodontia would not be so difficult. However, as we have stated, things must be taken as we find them and in summing up the conditions which we have to contend with and which we must understand, Angle[2] states that "An accurate knowledge of the forms and surfaces of the teeth and their occlusion, the surfaces, length, and inclination of their roots, and the structure, density and distribution of the alveolar process and peridental membrane is essential to an intelligent application of the principles of anchorage. The degree of resistance offered by different teeth varies greatly, according to their position, size, length and number of roots, the direction from which force is exerted, and in a manner of mechanical attachment to them."

Anchorage is defined by Pullen[3] as "The resistance selected as a base from which force is to be delivered for the movement of the teeth." This definition applies particularly to anchorage as employed in orthodontia, but as we have said before the principles of anchorage in orthodontic operations are the same as they are anywhere else. A more simple definition would be to say that anchorage is the resistance to overcome an applied force. It makes little difference where this resistance is obtained for as long as we have the resistance we have an anchorage. Guilford, in speaking upon the necessity of secure anchorage, illustrates this point as follows: "A jackscrew, for instance, placed under a house to elevate it exerts as much pressure upon the ground as it does upon the building, but as the resistance of the ground or foundation is much greater than that offered by the house, the latter rises when the screw is turned." In that instance we have a case in which the resistance is so much greater than the object that there is practically no moving of the resistance, but the object to be moved moves the entire distance.

Quoting Guilford again, he says, "If the jackscrew was placed horizontally between two piles of equal size implanted in the earth to the same depth, each would move equally when the screw was turned, because one offered no more resistance than the other, action and reaction being always equal."

In the second illustration we have a case of the resistance of the anchorage

[2]Angle: Malocclusion of the Teeth, 7th edition.
[3]Pullen: Johnson's Operative Dentistry.

and the resistance of the object to be moved being the same, therefore both objects move. Pullen states, in considering anchorage, that, "this resistance may be obtained from the teeth singly or in multiple, or from the top and back of the head by means of a headgear, and, except in the reciprocation of anchorage should always be greater than the force to be delivered from it in the movement of the teeth." This then brings us to the consideration of the sources from which anchorage is secured or the points from which we can obtain our resistance in the movement of the teeth. In considering the different forms of anchorage Lischer[4] classifies them first, *as to methods,* in which we give stationary and reciprocal, and secondly, *as to course,* into intermaxillary, intramaxillary, and extramaxillary.

We are here compelled to recognize two different factors which we must consider, namely the method of obtaining anchorage and the source from which it is obtained. Guilford says, to secure as stable anchorage as possible, therefore, we must resort to one of the following methods: (1) Combine the resistance of several teeth. (2) Counterbalance the force exerted upon the anchor tooth or the teeth in one direction by another force in the opposite direction, thus making the force reciprocal. (3) Use the teeth in one jaw to resist the force applied to move the teeth in the opposite jaw—intermaxillary. (4) Obtain anchorage or resistance at some point outside of the mouth or back of the head. It will be seen by studying this classification by Guilford that we get our resistance from teeth in one arch, teeth in the opposite arch, or from a point outside the mouth. This corresponds to the intramaxillary, intermaxillary, and extramaxillary anchorage as outlined by Lischer. We also notice in studying Guilford's analysis that he takes into consideration the resistance obtained from several teeth or the resistance obtained by balancing forces exerted in different directions, which gives us reciprocal anchorage, it being a form of intramaxillary anchorage. In considering the classification of anchorage a little farther, we notice that the resistance is obtained from a single tooth or may be obtained from one or more teeth, which makes it necessary to divide our anchorage according to the number of teeth which are used.

To Lischer's classification, which includes the method of obtaining the anchorage and the source from which it is obtained, we can also add a third group, which includes the number of teeth from which the anchorage is obtained. In the seventh edition of Angle's "Malocclusion of the Teeth," we find the different groups of anchorage which he describes, named regardless of the source, the method, or the number of teeth employed. The first form of anchorage described by Angle is named "Simple Anchorage," which is described as "that form in which the resistance is overcome by means of an anchor tooth or teeth of large size or more favorable location, and second, the form of attachment, to both anchor tooth and the teeth to be moved is hinged or pivoted, admitting of the tipping of both in their sockets." This definition of simple anchorage really includes two separate and distinct types, one of which depends upon the resistance being obtained from a single tooth, the other from a number of teeth. However, in both cases, the resistance is obtained from a tooth or teeth which is or are larger or more favorably located. Simple anchorage as described by

[4]Lischer: Orthodontics.

Angle is therefore one form of intramaxillary anchorage, because the resistance and the malposed teeth are both located in the same arch. He also describes stationary and reciprocal anchorage which are also forms of intramaxillary anchorage because they depend upon the method in which the appliance is attached to the anchor tooth. Stationary anchorage is described as "that form in which the attachment to the anchor tooth is essentially rigid so that the tipping is impossible and if moved at all it must be dragged bodily through the alveolar process in an upright position."

This form differs from that which Angle describes as simple anchorage because in simple[5] anchorage, the attachment of the anchor tooth is essentially pivotal, or hinged, so if sufficient force is supplied on the anchor tooth, the anchor tooth will tip, but in stationary anchorage, the same kind of a force may be applied to the anchor tooth, but owing to the construction of the appliance, the anchor tooth must be dragged bodily. This illustrates what we mean by methods of attachment, which influences the classification of anchorage.

The third form of intramaxillary anchorage such as Angle describes is known as reciprocal anchorage which he says is not a distinct type of anchorage, with which I disagree. Reciprocal anchorage is as much of a distinct type as "simple" and stationary, because it derives its name from the methods in which the appliance is attached to the anchor teeth and the malposed teeth. In other words, in reciprocal anchorage, the appliance is so constructed and attached that the force of one malposed tooth is pitted against another malposed tooth with the idea of moving both into the line of occlusion. In reciprocal anchorage, the construction of the appliance is such that the action and reaction are both utilized, to induce the movement of a malposed tooth.

We have mentioned these three types of anchorage as described by Angle to illustrate what is meant by methods of attachment or construction of appliance in order to give different forms of anchorage. Each one of these three types may be further modified or classified according to the number of teeth which are employed, whether a single tooth is used for anchorage or whether a number of teeth are used for anchorage.

In giving an outline of the classification of anchorage, as we understand it today, we first divide anchorage according to the origin from which the resistance is retained. The oldest form which we know anything about probably is intramaxillary anchorage, which is divided into three types according to the methods in which the resistance is retained from the teeth.

Intramaxillary anchorage is that form of anchorage in which the resistance necessary to overcome the malposed tooth is located in the same arch in which the malposed tooth is located. We have the three types as described by Angle, which are named primary (which is the same as Angle's "simple" anchorage), stationary, and reciprocal. Primary anchorage is that form of anchorage in which the resistance necessary to overcome the malposed tooth is derived from a tooth or teeth larger or more favorably located. That type of primary anchorage in which the resistance is obtained from a single tooth, we call simple primary anchorage because we have but a single tooth, while that form in which we enlist two or more teeth is known as reinforced or compound.

[5]We now call the form of anchorage which Angle described as simple anchorage and which is also called "Simple" in the author's book, "Practical Orthodontia," *primary anchorage*, to avoid confusion which arises in speaking about anchorage when classified according to numbers.

Stationary intramaxillary anchorage is that form in which the appliance is so constructed and attached to the anchor tooth that if the anchor tooth be moved at all, it must be dragged bodily through the process. This distinction is mentioned in comparison to primary anchorage, for in primary anchorage you do not depend on obtaining any resistance from the attachment or construction of the appliance; the entire resistance is obtained from the size and location of the tooth. In primary intermaxillary anchorage, we must necessarily use an anchor tooth, which is large and strong. This is not necessary in stationary intramaxillary anchorage, because in the construction and attachment of the appliance we can so favor our anchor tooth that a tooth of equal size will give sufficient resistance to overcome or move its neighboring tooth. In other words, one central incisor can be made to give resistance to move another central incisor. One premolar can be made to give sufficient resistance to move another premolar or even one premolar can be made to give enough resistance to move a canine, and this resistance is obtained through the construction and attachment of this appliance to the anchor tooth. Stationary anchorage, like primary anchorage, may be divided into simple or compound, depending upon the number of teeth which are enlisted in that form of anchorage.

Reciprocal intramaxillary anchorage is that form of anchorage where the resistance necessary to overcome one malposed tooth is obtained from another malposed tooth, with the idea of moving both in the line of occlusion by utilizing the action and reaction obtained from the appliance. Reciprocal anchorage can be divided first into simple and compound, depending upon the number of teeth which are employed. It can also be divided into stationary and simple, depending upon whether the anchor tooth is allowed to tip or is made to move bodily through the process. As a result of this you will readily see that reciprocal intramaxillary anchorage admits of more combinations, of a greater variety of classes; and owing to the fact that it does admit a greater variety of classes, it becomes more complicated and more difficult to understand than any form of anchorage we have mentioned heretofore. Reciprocal anchorage is also the most useful owing to the fact that we utilize action and reaction and none of the force exerted by the appliance is allowed to go to waste.

The next division of anchorage is based upon the source of obtaining a resistance, and is known as *intermaxillary anchorage,* which is defined as that type of anchorage in which the resistance is obtained from an arch different from the one in which the malposed tooth is located. In other words, the resistance necessary to move a malposed tooth or teeth, is derived from a tooth or teeth located in the opposite arch.

Intermaxillary anchorage, admits of the same divisions as intramaxillary anchorage, namely, according to the number of teeth moved, simple and compound. As to the manner of resistance obtained from the teeth, namely primary, stationary and reciprocal.

The third type of anchorage depending upon the force applied, is *extramaxillary anchorage,* of which we have three types, named according to the anatomical point from which the resistance is obtained. They are: occipital anchorage, which is obtained from the occiput region, facial anchorage, which is obtained from the maxillary teeth, and cervical anchorage, which is derived from the cervical vertebræ. However, in both cases, the resistance is obtained from a tooth or teeth which are larger or more favorably located.

(To be continued.)

AN EXPERIMENTAL INVESTIGATION OF THE PHARMACOLOGICAL ACTION OF NITROUS OXIDE

By D. E. Jackson, Ph.D., M.D., St. Louis, Mo.
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In the years 1844 and 1846 a peculiar and immortal glory fell upon the dental profession. For in the first of these years Horace Wells, a dentist of Hartford, Connecticut, first used nitrous oxide as an anesthetic in the extraction of teeth. In 1846 William T. G. Morton, a former pupil and partner of Wells, first made known to the world and publicly demonstrated the anesthetic properties of ether. Thus the earliest practical beginnings of modern analgesia and anesthesia must be credited to the dental profession. It has accordingly seemed especially appropriate that this article, the major portion of which has already appeared elsewhere,[1] might also be published here, for the great majority of American dentists will scarcely have access to the former publication.

Since this article deals almost entirely with the oldest of the modern anesthetics, nitrous oxide, it may be of further interest to add that many of the modern nitrous oxide machines have been devised either by dentists or by others who have had in mind especially the needs of the dental profession while developing these forms of apparatus.

In the early days nitrous oxide was administered pure or almost pure, air being very generally excluded. This led to the production of asphyxia after a very brief period and thus the duration of the anesthesia was necessarily short. At a later period it was appreciated that a certain admixture of air with the gas was feasible and even often improved the character and extended the duration of the anesthesia. In 1868 E. Andrews of Chicago first used pure oxygen with nitrous oxide. This was a great advancement, which, although not generally appreciated at that time, has now come to be fully recognized as indispensable in the scientific administration of nitrous oxide.

Some months ago I devised a closed method for the administration of nitrous oxide and other anesthetics in conjunction with oxygen. I have used a number of different types of apparatus in connection with this method one of which has been described in a former publication.[2] My chief object in the present article is to discuss certain features of the pharmacological action of nitrous oxide as studied by this method. No morphine, scopolamine or other hypnotic has been used in any of the experiments herein reported.

I may refer briefly to an improved form of apparatus which I have used in these experiments (Fig. 1). A rotary pump of less capacity than that used in the device previously described is attached to a very much smaller and more compact frame. The chief object in this has been to simplify the apparatus and to reduce its size and weight. A number of valves, tubes, etc., shown in the illustration have been found by experience to be unnecessary, but in the experimental development of the device they were included as precautionary measures. The apparatus carries only two tanks, one for oxygen and one for nitrous oxide, for experience has shown that since tanks need to be renewed only at con-

siderable intervals, and, if the breathing bag be filled moderately full at the moment when either tank becomes exhausted there will be ample time to remove the empty tank and replace it by a new one before a fresh supply of the gas (generally oxygen, of course) is required. Realizing the great value of simplicity and lightness in any form of apparatus intended for constant use, I have spent much time and energy in trying to produce as simple a device as possible. It is perfectly evident that the apparatus here shown is much more complicated than it need be, but for the benefit of others who may be interested in the sub-

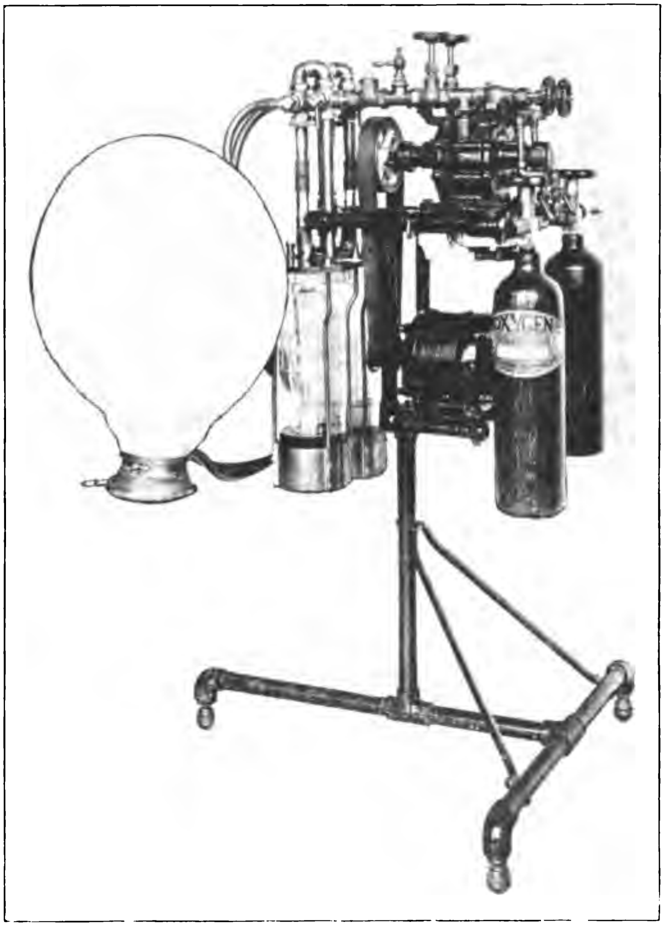

Fig. 1.—Nitrous oxide apparatus with large bag as used for experimental purposes. (For discussion, see text.)

ject of nitrous oxide anesthesia, I have thought it worth while to include here an illustration of the apparatus with which much of the work discussed below has been carried out. For a detailed description of the general principles on which the device is operated I must refer the reader to the article indicated above. By further reference to the diagram shown in Fig. 2 it will be seen that by means of a motor and a rotary air pump, air or other gaseous or volatile substances (chiefly nitrous oxide and oxygen so far as the present article is con-

cerned) are kept circulating within a closed system of tubes and vessels, and through a breathing bag into and out of which the animal breathes.

The vessels are two in number and consist of glass jars, the one containing sulphuric acid which serves to sterilize, dry and warm the air (or gases) which are washed through the acid, while the other jar contains sodium hydrate solution through which the air or gases, including the exhaled CO_2 from the patient are washed. The CO_2 is immediately absorbed by the sodium hydrate forming sodium carbonate and water according to the following equation:

$$2\,NaOH + CO_2 = Na_2\,CO_3 + H_2O.$$

The sodium carbonate being a soluble salt of course remains in solution (to-

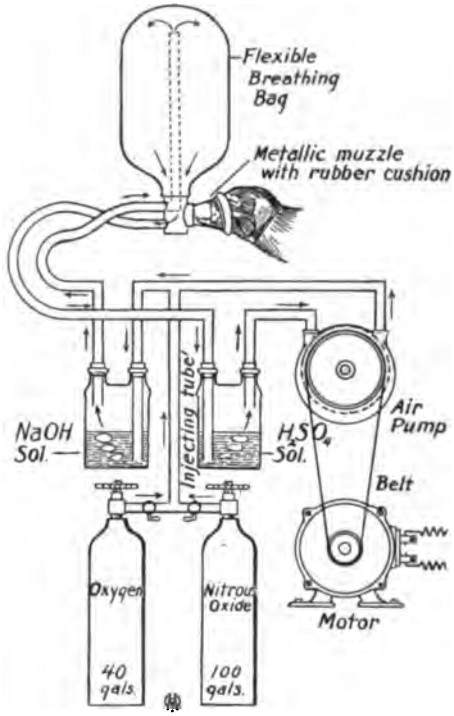

Fig. 2.—Schematic diagram to explain the plan of construction of the apparatus shown in Fig. 1. The motor turns the rotary air pump which keeps the air (or gas and oxygen) circulating. (For discussion, see text.)

gether with the H_2O formed) in the jar, the CO_2 being thus removed from the air (or nitrous oxide and oxygen) which the animal breathes. During this process the oxygen is consumed (250 to 300 c.c. per minute for an adult man at rest) by the animal or patient. More oxygen is injected into the system from time to time in just such quantities as the animal actually consumes. The nitrous oxide, being a stable gas, is not broken down at all either by the animal or by the acid or sodium hydrate. Consequently there need be but little waste of the N_2O and only a small amount (experimentally I have estimated that from 1½ to 3 gallons will be necessary for a man weighing 160 pounds) is required to saturate the blood sufficiently to produce anesthesia. When a given amount of

N_2O is injected into the closed system and breathing bag, the animal, whose lungs virtually form a part of the closed system, will at once begin to absorb N_2O into its blood from the pulmonary alveolar walls. This absorption goes on until an equilibrium in the quantity of N_2O contained in the animal's blood and tissues on the one side and that contained in the breathing bag and tubes on the other is established. It is important, however, to remember in this connection that the affinity of the blood and presumably of the central nervous system is greater for N_2O than is the affinity of water for N_2O. So far as is known at present N_2O does not form any special chemical combination with the blood or other tissues of the body. It is apparently held in solution in the blood and tissues in the same way as any other indifferent gas dissolves in a liquid, i.e., in direct proportion to the partial pressure exerted by the gas on the liquid. The lipoid content of the blood and central nervous system is generally considered to account for the increased solubility of the gas in these tissues over that in water.

The breathing bag and face-piece shown in Fig. 1 are also modified considerably from that which I first used. The bag shown here I have found well adapted for experimental observations. It is chiefly from this standpoint that I want to discuss the action of nitrous oxide in this article. This bag holds three gallons, but the sides of the bag are flat and when not in use fall together as the air or gas passes out. When in use only about one or two gallons of air or gas need be injected into the bag and this permits the subject to have a full and free opportunity to breathe in any way he pleases. It is desirable that no excess pressure, as from an overfilled bag, be introduced to embarrass the breathing of the subject. The excess amount of work which may thus be easily thrown on the respiratory apparatus in the course of an hour may be astounding, as a brief mathematical calculation will readily show. And the problem is still further complicated both directly and indirectly by the embarrassment to the heart and lung circulation which the amount and peculiar application of this excess work involves. A further feature to be noted in the face-piece is the large opening, about three and one-half inches in diameter, which connects the bag to the air cushion resting on the face. Thus the subject breathes almost directly into the large flexible bag and obstruction of the respiration is reduced to a minimum. While this bag and face-piece serve very well for experimental observations, there are certain objections which may be made to them from a practical standpoint. The first of these is the difficulty of making an air-tight contact between the subject's face and the rubber cushion on the face-piece. The second is the inconvenience of having the large bag near the patient's head. At present, however, I wish to avoid any extensive discussion of the clinical side of this subject.

THE GASES INVOLVED IN NITROUS OXIDE ANESTHESIA.

The pharmacological relations of at least four gases must always be considered in nitrous oxide anesthesia. These are N_2O, oxygen, CO_2, and nitrogen. And it may be worth while to remember that a small amount of argon, neon, crypton, xenon, etc., are also present. Ordinarily these gases are supposed to be inactive in the animal organism, but under the peculiar conditions established in the gaseous content of the body under nitrous oxide anesthesia, I am inclined to

believe that the presence of these substances, at least at the beginning of the anesthesia, should not be entirely forgotten.

It should be emphasized that the method which I have here used permits investigation of peculiar gaseous relationships which no other device heretofore employed for this purpose could well reveal. For by this method the supply of the four gases (N_2O, CO_2, N, and O) concerned in the animal's respiration may be separately and independently controlled. The CO_2, of course, is eliminated by the animal, but it may be allowed to accumulate in the breathing bag for experimental purposes and its relative action in combination with the other gases thus studied. The relative effects of CO_2 and O in ordinary forms of breathing and in asphyxia have been thoroughly studied by numerous investigators.[3] When, however, nitrous oxide is introduced, the conditions are very materially changed and only a small amount of work has been done on this phase of the problem.

It was supposed by Sir Humphrey Davy that nitrous oxide was decomposed in the body which thus became flooded with an excess of oxygen which was promptly changed to carbon dioxide. This carbon dioxide then acted as a depressant and caused the anesthesia. It was later shown that nitrous oxide was not thus broken down but was excreted by the lungs in the same form as that in which it had been absorbed. The theory then became prevalent that nitrous oxide acted solely by excluding oxygen from the tissues and that its action was chiefly a matter of asphyxia. That asphyxia may, and in practice certainly does often play a considerable part during the production of the anesthesia, no one at present doubts. But it has been thoroughly established that nitrous oxide possesses distinct specific depressant powers of its own on the central nervous system. In 1897 Kemp[4] published a series of observations on the gaseous content of the blood during nitrous oxide anesthesia. He drew off blood from the femoral artery of dogs anesthetized with various mixtures of N_2O and air and of N_2O and O, and found that complete anesthesia could be produced by the gas when the blood contained quantities of oxygen fully capable of maintaining consciousness and of carrying on the ordinary process of metabolism. When nitrogen was substituted for the N_2O, the percentage of oxygen breathed remaining the same, the anesthesia gradually passed off and the animal regained consciousness. And it has been found by the late Sir Frederic W. Hewitt[5] that a mixture of nitrous oxide 80 per cent and oxygen 20 per cent (the amount present in air) is fully capable of producing anesthesia in suitable subjects. These observations prove beyond doubt that N_2O possesses specific depressant powers on the central nervous system. It has also been shown by Kemp as well as by others that under N_2O anesthesia the CO_2 content of the blood is greatly reduced below the normal. But in most cases, however, it has been found that the oxygen content of the blood is reduced in even still greater degree below the normal than is the carbon dioxide. As ordinarily administered N_2O causes the nitrogen (and presumably the argon, etc.) contained normally in solution in the blood and tissues to be rapidly washed out of the system. Kemp's blood analyses for the dog show in several experiments a complete absence of nitrogen from the gases drawn off by the vacuum pump. It is to be noted that in all other forms of anesthesia the nitrogen (about 1.7 vol. per cent) remains dissolved in the blood.

Does the absence of this supposedly inactive gas in any way affect the anesthesia? In many instances I have observed dogs going under the influence of N_2O in which it appeared to me very probable that the elimination of this nitrogen was essential to the production of successful nitrous oxide anesthesia. It is, unfortunately, extremely difficult to prove this point. For one must, as a general rule, empty out most of the air (nitrogen) from the apparatus (and lungs and tissues of the animal) in order to fill this space with nitrous oxide so as to be able to obtain a sufficiently high percentage of the gas to produce the anesthesia. This makes difficult the solution of the question as to whether or not the absence of the nitrogen in any way influences the nature of the anesthesia.

In most forms of nitrous oxide apparatus used heretofore breathing had to be carried on under a greater or less degree of pressure. It is interesting to consider what influence, if any, this may have in tending to dam back the CO_2 produced in the tissues. While this gas did not apparently accumulate in large quantities in the blood in the analyses made by Kemp, still one is inclined to suspect that the tissues may have been trying to form the ordinary amounts of the gas but were either unable to do so or else they could not pass it over to the blood. And any such accumulation of CO_2 in the tissues may very well influence the nature of the anesthesia produced. And similarly any of the immediate precursors of CO_2, if allowed to accumulate in the tissues or blood, may affect the character of the anesthesia produced.

THE SYMPTOMS PRODUCED BY NITROUS OXIDE.

I have studied this topic both from the standpoint of animals and from that of man.

A frog placed in an atmosphere containing a high percentage (90% to 98%) of N_2O becomes well anesthetized in from three to four minutes. When again placed in fresh air the animal fully recovers in about one minute. Profound anesthesia is readily obtained.

The symptoms in dogs vary greatly with the animal and the method of administration. Fig. 3 shows a record of the respiratory movements in a dog just beginning to inhale N_2O. The animal was lying quietly on the table and made no resistance in any way. The record was obtained by tying a stethograph around the chest wall and connecting it by rubber tubing to a recording tambour. The first part of the tracing shows the normal respiratory movements when the animal was breathing a sufficient percentage of oxygen and the CO_2 was not allowed to accumulate to excess. At the point indicated N_2O was run into the breathing bag and shortly thereafter the depth of the respiration began to increase. This is mainly due to the action of N_2O. It is the typical effect of this gas on the respiration. There is one other point to be considered in the experiment, however, and that is the fact that in this case when the N_2O was run into the bag then the oxygen which the bag contained was considerably diluted. This would also cause the animal to breathe more deeply. But independently of this dilution of the oxygen, the first effects of nitrous oxide in sufficient concentration appear to be to stimulate the respiratory center. After a time, as the animal passes more fully under the influence of the gas, the depth of the respiration decreases while the rate varies somewhat, but on the whole is accelerated beyond

the normal. This does not seem to be due to any accumulation of CO_2 in the breathing bag or apparatus, for it is very easy to wash out the CO_2 as fast as it is formed. The animal usually does better, however, if a certain amount of rebreathing and CO_2 accumulation is permitted.

These same phenomena occur in the human subject. It is very interesting to experience the beginning action of the gas. If one fills the bag partly full of oxygen and breathes this for a while (washing out the CO_2), he may at first note a very slight sense of fullness in the head and possibly there may be a feeble flushing of the skin especially of the face and neck. Whether this is due to a slight CO_2 accumulation in the lungs (dead space, etc.), caused by the small amount of obstruction to the normal respiration, or is due entirely to excitement or the mere feeling that one "expects something" I have not been able to determine. It is of but little consequence, however, and soon passes off as one ad-

Fig. 3.—This tracing shows the respiratory movements of a dog to which (at X) nitrous oxide (plus oxygen) was administered. There is a slight mechanical exaggeration of the respiration record because the animal had been breathing mainly with its diaphragm before the gas was given, but after this the chest movements became much increased. The stethograph recorded more of the thoracic movements than it did of the abdominal.

justs himself to breathing into and out of the bag. Slight odors, as from a new rubber bag, or of oil from the pump, etc., sometimes cause one to be a little apprehensive. And the mere act of fixing the attention on the respiration is sufficient to cause certain minor variations in most subjects. When the N_2O is turned on, however, there is an immediate feeling of ease in breathing. The sensation can best be compared to the effect of oiling a new machine. One is somewhat surprised how readily he can breathe deeply and fully and without special exertion. This sensation does not occur if one instead of running nitrous oxide into the bag, should fill it to a corresponding degree with oxygen. I have been inclined to believe, therefore, that it is due to a direct stimulation of the respiratory center by the N_2O. I have considered the question of whether or not the processes of diffusion of the gases in the lungs, or the rate or ease of absorption or excretion of the oxygen or CO_2 through the alveolar epithelium might be influenced in any way by the presence of N_2O rather than of nitrogen. I have

not been able to reach any conclusion on these matters. It seems probable that certain obscure changes are produced in the metabolism of the tissues on account of the subnormal CO_2 and oxygen content of the blood, as shown by Kemp. It would be interesting to know whether or not these low percentages of CO_2 and oxygen persist in the blood in those cases in which anesthesia is produced by approximately 80 per cent N_2O and 20 per cent oxygen as in Hewitt's experiments. I have occasionally believed that in rare instances in dogs which were fully anesthetized I could raise the percentage of oxygen in the bag to perhaps 30 per cent without allowing the animal to revive. In this case, of course, while I might markedly increase the percentage of oxygen in the bag, I did not correspondingly lessen the amount of N_2O in the animal and in the apparatus. In this feature there is a great difference between the apparatus which I have here used and most other forms of nitrous oxide machines, for in these if the amount of oxygen administered is increased, this generally means a *corresponding diminution of the amount of N_2O given with correspondingly increased chances for variations in the character of the anesthesia.*

I have noted only occasionally, as have a number of my students, that just as one begins to breathe a fairly concentrated mixture of N_2O, there may be detected a faint metallic sweetish taste on the tip of the tongue. The sensation reminds one of the taste of saccharine. In my own case this taste has never lasted for more than a second or two, but one student was able to detect it over a prolonged period. It is probably due to N_2O carried in the blood from the lungs to the taste organs.

It will be noted from Fig. 3 that the animal did not struggle as the gas was administered. In some cases I have seen dogs go quietly to sleep and apparently never be conscious at all that they were being anesthetized. In a gentle animal which is especially susceptible to the gas, this may frequently occur. It is by no means the rule, however, and there is often struggling especially if the animal was excited before the anesthesia was started. It is well known that certain human subjects are especially resistant to the gas and I have frequently found this to be true for dogs. In some cases I have been entirely unable to obtain any true anesthesia at all. In these cases cardiac slowing and other complications nearly always come on as one attempts to crowd the gas. This appears to be partly due to stimulation of the vagus center in the medulla for section of the vagi usually accelerates the heart and this is generally even more marked after atropine. I have seen three or four especially striking cases of this kind. An animal which is excited or struggles is much more liable to manifest these cardiac symptoms. After atropine the animal usually takes the gas considerably better, indicating better aeration of the blood in the lungs from the improved circulation. The slowing of the heart may be very marked and apparently may be the cause of death in some cases. I have not taken string galvanometer tracings of the hearts of these animals, but this would be instructive. It has seemed to me in one or two instances that peculiar arrhythmical contractions were set up in the heart and that this finally ended suddenly either with complete stoppage of the heart, or with the establishment of a condition resembling heart block. The cause of these reactions is not at all clear. One would suspect a lack of oxygen, or CO_2 poisoning, but when the CO_2 is well washed

out of the gases breathed and the conditions are the same as those under which other animals have been well anesthetized, then one is inclined to look for a difference in the animals. I suspect that very nearly, if not quite this same thing, may have occurred in a few instances in man.[6] For that reason I wish to refer briefly to Fig. 4 which is a tracing of the apex beat of a dog which was given nitrous oxide. The animal was not a good subject, but was finally apparently well anesthetized. After the anesthesia had continued for perhaps half an hour, the pulse in the femoral artery became irregular and finally stopped rather suddenly. With considerable difficulty the animal was revived by means of intermittent compression of the chest. But when the respiration was restored, the animal did not promptly regain consciousness and remained in a semicomatose or somnolent condition for two or three hours. It was noticed about five hours after the animal revived that the heart was irregular and the tracing here shown was made. The animal improved and in about a week the heart had apparently returned to normal. The animal was kept for forty days thereafter, but no further cardiac disturbance was observed.

It seems evident to me that the human subject must be very much more susceptible to nitrous oxide than is the average dog. The anesthesia in all cases is

Fig. 4.—Tracings of the apex of the heart in a dog in which under nitrous oxide anesthesia cardiac irregularities developed. For a full description, see text. This tracing was taken about five hours after the animal had been anesthetized. At this time it was observed by Mr. John A. Higgins that the animal was in a dazed or semicomatose condition, and that the heart beat was very abnormal. The record here shown was then made.

of a much lighter form than that produced by ether. In dogs it is as a rule impossible to destroy the corneal reflex, for in the deepest anesthesia in these animals the slightest touch of the cornea or eye lid or even eye lashes causes immediate winking. The eyes remain open and keep up peculiar rolling or staring movements so that one often wonders whether or not the animal is fully anesthetized. If the gas be removed suddenly, however, the animal wakes up and stares about in a way which shows that it had been completely unconscious. During the anesthesia the pupils are dilated but the light reflex is preserved.

THE ACTION OF NITROUS OXIDE UNDER VARYING CONDITIONS.

If pure N_2O be inhaled, unconsciousness results in a period of from thirty to sixty seconds. But if oxygen be added to the inhaled gas, the time required to produce unconsciousness rapidly increases as the oxygen rises from zero up to five, ten or more per cent. With more than ten or twelve per cent oxygen content mixtures of nitrous oxide and oxygen usually produce unconsciousness only after considerable periods or not at all, depending on the patient. There seem to be great variations in this respect, however, in the human subject, and

I have noted a similar reaction in animals. I should like to emphasize this point in particular since it has a direct bearing on the administration of nitrous oxide by the method which I have here used.

It will be noted by reference to Figs. 1 and 2 that there is a considerable "dead space" in the apparatus. The wash jars, tubes, pump, etc., and the breathing bag all represent space which in the beginning contains air. When the animal is connected to the apparatus then its lungs also add "dead space" to the system. This "dead space" contains oxygen and nitrogen. The oxygen can be readily used up by the animal, but the nitrogen must be gotten rid of. The amount of this nitrogen depends on the construction, size, etc., of the apparatus and on the size of the animal. The blood (and tissues) of the animal also contain about 1.7 per cent of nitrogen which presumably diffuses out into the lungs and is then breathed out when nitrous oxide and oxygen are administered. It is necessary to remove a large part of this nitrogen from the apparatus to secure the best success. This is done by filling the bag partly full of nitrous oxide and running the pump for a while. The animal breathes the mixture of air and N_2O and absorbs a portion of the gas, while at the same time some of the nitrogen in its blood is breathed out. The sodium solution and the sulphuric acid in the wash jars also absorb some nitrous oxide. In a little while the bag is emptied out into the air. This is accomplished by opening a valve on the right (positive) side of the machine while the pump is running. In one or two seconds the bag can be emptied as much as desired and then more N_2O is run in until the bag is about one-half or two-thirds full. This is repeated about three or four times as a rule with dogs. One should not hurry this process. It usually takes at least five minutes to anesthetize a dog deeply and any attempt to crowd the gas faster generally excites the animal and does not improve the anesthesia. It is better to proceed slowly and allow the animal's blood to become as nearly saturated as possible for each concentration of the N_2O. In this manner the action of the drug is brought on slowly and in a perfectly successful experiment the animal may be fully anesthetized apparently without being conscious that anything unusual is occurring. Often it is not necessary to give any oxygen until the animal is anesthetized, for the oxygen in the apparatus and in the lungs, etc. ("dead spaces") serves to keep the animal in good condition for some time. When needed, however, more oxygen should be injected.

It may seem that five minutes is an unreasonably long time to require for the production of nitrous oxide anesthesia. We should remember, however, that much more time than this may be required with ether, etc., and when we think of anesthetizing an animal in thirty to fifty seconds with nitrous oxide it is interesting to consider the possibility of doing this same thing with chloroform or ether vapor which are exceedingly well absorbed by the blood. And it is probable that in any rapidly produced nitrous oxide anesthesia there may be a considerable element of asphyxia which is undesirable.

In this connection I should like to refer to some physiological experiments[7] on respiration which involve certain features usually concerned in nitrous oxide anesthesia.

"1. *The Immediate Effects of Total Rebreathing* (*Due Chiefly to Excess Carbon Dioxide*).—The nostrils are compressed with a nose-clip and the sub-

ject breathes from and into a rubber bag containing 20 to 40 liters of air. The amplitude of respiration is soon augmented, and in the course of a few minutes the subject is panting heavily forty times a minute. He usually develops a typical carbon dioxide headache, but this wears off in fifteen or twenty minutes after the experiment is ended." These results are produced by breathing for a *"few minutes"* into a closed bag. If in addition to these effects, which are due chiefly to carbon dioxide accumulation, there be added the further effects of oxygen want which are usually present from the very beginning in the administration of nitrous oxide, what will be the results of these purely physiological phenomena when complicated by the addition of nitrous oxide in those forms of apparatus in which rebreathing into and out of a closed bag is carried on for considerable periods of time?

"2. *The Effects of Insufficient Oxygen Without Excess of Carbon Dioxide.*—The above mentioned bag is refilled with 20 to 40 liters of fresh air and the experiment performed again, but with this difference, that a vessel of 1 or 2 liters capacity filled with soda-lime or broken sticks of sodium hydrate is placed between the bag and the subject's mouth so that he breathes through it into and from the bag. The carbon dioxide exhaled by the subject is thus absorbed, and he gradually consumes the oxygen in the bag. As a rule there is *no noticeable deepening or quickening of the breathing,* and the subject will first become cyanosed and then unconscious without appreciable augmentation of breathing. This experiment should *always be carefully supervised,* as it is not free from danger. If continued for more than ten minutes, it is usually followed by a severe frontal headache, developing slowly for several hours thereafter, together with other ill effects and lasting from twenty-four to forty-eight hours." It is particularly interesting to consider this experiment in connection with those forms of nitrous oxide apparatus in which the patient inhales the gas (plus a varying but usually small amount of oxygen) from a tank or reservoir and then exhales out into the open air. In these machines the carbon dioxide is probably fairly completely removed as fast as it is exhaled from the lungs. The small percentage of oxygen usually given (e.g., from two to ten or twelve per cent) with the nitrous oxide may cause a rather close simulation of the conditions established in the above experiment in which *cyanosis* and *unconsciousness* may be produced *without any anesthetic.* I should like to give one further quotation bearing on this point from Haldane and Poulton.[8] * * * "Still more sudden exposures to anoxemia occur when air containing little or no oxygen is breathed; for in this case the oxygen previously present in the alveolar air, and even in the venous blood, is rapidly washed out; the result is that consciousness is suddenly lost *without evident preceding hyperpnea,* although abundance of CO_2 is present in the arterial blood. Haldane and Lorrain Smith observed sudden loss of consciousness after 50 seconds on breathing air which was afterwards found to contain 1.8 per cent of oxygen. During any exertion the loss of consciousness is still more sudden. Thus it is a common experience with miners going into an atmosphere of nearly pure fire damp (CH_4), or climbing up so that their heads are in the gas, that they drop suddenly as if they were shot."

I do not care to discuss this point further, but may state briefly that my own experiments, together with the results obtained by others, have led me to

Fig 5.—Blood pressure and respiration in a dog anesthetized with ethyl chloride. At three places, as shown on the record, nitrous oxide was run into the breathing bag. This was done in order to observe the effects of the gas on the circulation and respiration. The results were practically nil so far as can be observed from the record.

conclude that it is impossible to obtain a rapid (1 minute) production of anesthesia and unconsciousness in dogs with nitrous oxide and oxygen at atmospheric pressure unless the oxygen content of the mixture is so low that the loss of consciousness is due *almost entirely* to the lack of oxygen. Presumably, with certain modifications, this is true in the human subject also. On the other hand it seems probable that in all dogs which do not possess a special idiosyncrasy against the gas, mixtures of nitrous oxide and oxygen containing sufficient amounts of the latter to avoid most if not all asphyxial effects, may be used to produce anesthesia ***provided sufficient time be allowed for the gas to act and the CO_2 be completely removed as fast as it is excreted by the lungs.*** If a high per cent of oxygen is used, anesthesia cannot be quickly produced but asphyxia may be avoided. The time required may be considerable, perhaps from five to fifteen

Fig. 6.—This animal was anesthetized with nitrous oxide. At the point indicated ethyl chloride was injected into the bag. There is an immediate fall in pressure and the respiration is much diminished.

minutes or longer. But as the tissues gradually become more and more saturated with the gas, there will be a gradual depression of the central nervous system which will finally result in unconsciousness.

It was long ago observed by Goldstein[9] that anesthesia appears more quickly and with a proportionately less degree of asphyxia, the higher the organization of the brain—namely, earlier in man than in laboratory animals. I have been able to confirm this observation many times. And in addition the anesthesia appears as a general rule to be deeper in man than in dogs, although in some animals a profound anesthesia may be readily obtained if all carbon dioxide effects be carefully avoided.

It seems probable that in average cases the heart and circulation are not much affected by the gas. Fig. 5 shows the result produced by injecting nitrous oxide into the breathing bag when the animal was already anesthetized by ethyl chloride. Three injections were made but the effects on both blood pressure and

respiration were practically nil. This corresponds very well to the injection of an ordinary drug solution into the femoral vein when an animal is anesthetized with ether. (Fig. 6 shows the reverse of this experiment and illustrates the action of ethyl chloride on an animal already anesthetized by nitrous oxide.) As a kind of check on these experiments another tracing (Fig. 7) is shown in which at two places a small amount of carbon dioxide was injected from a tank into the breathing bag. There is an immediate stimulation of the respiration and the blood pressure falls, probably from a direct action on the heart. The gas was quickly emptied out and the bag was again refilled with nitrous oxide plus a suitable amount of oxygen. This shows quite well the action of even small amounts of carbon dioxide. I strongly suspect that some such action as this, either by excess of carbon dioxide, or from lack of oxygen, or both, constitutes the real cause of the undesirable after effects which are liable to follow from pro-

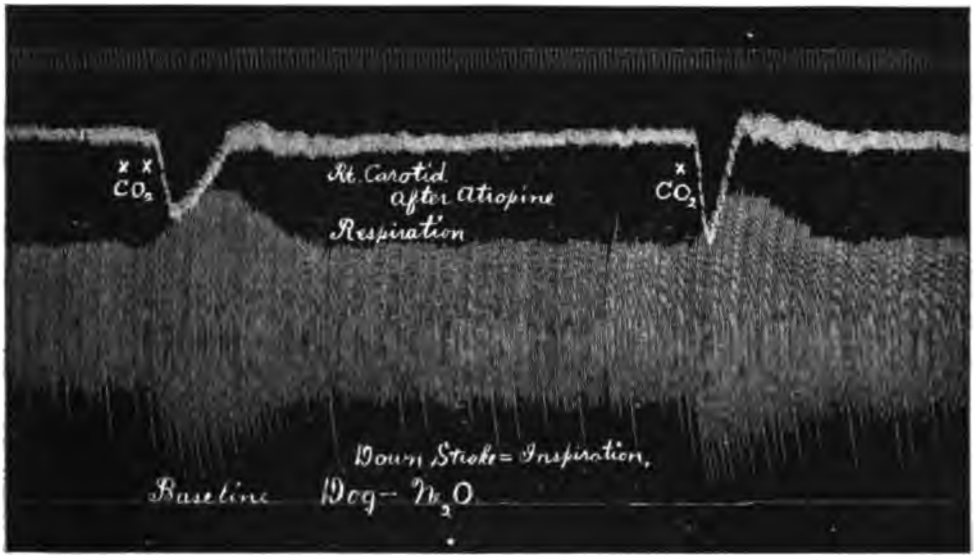

Fig. 7.—This tracing was made in a class experiment by Messrs. Mitchell, Day, Lueking and McKee. It shows the results produced on the respiration and blood pressure by injecting (twice) a small amount of carbon dioxide into the breathing bag while the dog was anesthetized by nitrous oxide. In each case the CO_2 was quickly emptied out of the bag after the animal began to show marked symptoms.

longed nitrous oxide anesthesia. And I am inclined to believe that these after effects may be very generally avoided by a correct and scientific administration of the nitrous oxide.

I have repeatedly observed, as have others, independently in my laboratory, that if one breathes a mixture of nitrous oxide and oxygen for a certain time, for example five minutes, and then passes under the influence of the gas to a given degree, he can then considerably increase the quantity of oxygen in the bag without lessening the influence of the nitrous oxide so far as the subject of the experiment himself can determine. The reason for this appears to be as follows: On breathing the N_2O at first the whole body of the subject after a time becomes saturated with the gas at the given partial pressure. (As the first portion of gas is absorbed, one can see the bag shrink fairly rapidly with ani-

mals.) More N_2O must be run into the bag to replace that absorbed. But after the anesthesia or analgesia has reached a given degree, then if no more gas, but only oxygen, is given, the effects of the N_2O on the subject should remain fairly constant. It will be noted that the gas is excreted only into the bag from which in a given time approximately the same quantity of N_2O will pass back again into the blood. Supposing the bag was filled to the amount of two gallons* with 90 per cent N_2O and 10 per cent oxygen. If then one adds a quart of oxygen to the bag the per cent of oxygen the patient would breathe should be increased by one-ninth of the total amount of mixed gases in the bag after the quart of oxygen is added. It would appear that this oxygen should be readily absorbed by the

Fig. 8.—The animal was anesthetized with nitrous oxide. At the point indicated adrenaline (½ c.c., 1-10,000) was injected intravenously. The vagi were intact. (For discussion, see text.)

lungs in approximately the same proportion and quantity as oxygen is absorbed by the blood from the air (which contains oxygen in about the same proportion as the bag would now contain it, i.e., about 20 per cent). This would probably not be quite correct, for nitrous oxide has some power to displace oxygen from its solution in water (Sir Humphrey Davy[10]), and this probably holds good for the blood in the pulmonary capillaries also. On the other hand, when the quart of oxygen is run into the bag, the latter will be expanded by a volume equal to one quart and into this space the nitrous oxide already in the bag and also that dissolved in the blood and tissues of the subject, may diffuse. But if, for ex-

*For clearness of description I have assumed that the *volume* of one gallon of the gas may be considered equal to the volume of four quarts. We need not consider variations of temperature, pressure, etc.

ample, the blood and tissues of the subject had absorbed two gallons of N_2O and the bag contained two and one-fourth gallons of (mixed) gases after the quart of oxygen was added, then there would be a chance for the N_2O to be diluted by approximately one-seventeenth of the total volume of gases or 5.8 per cent. At that time the subject might be breathing almost 20 per cent of oxygen and this is readily absorbed by the hemoglobin of the blood. In other words, the relative increase in percentage of oxygen breathed when a given amount of oxygen is added to the bag, is greater than is the relative amount of dilution of the nitrous oxide with which the subject is saturated after the oxygen is added to the bag.

It was shown by Van Arsdale[11] in 1891 that the breathing of nitrous oxide

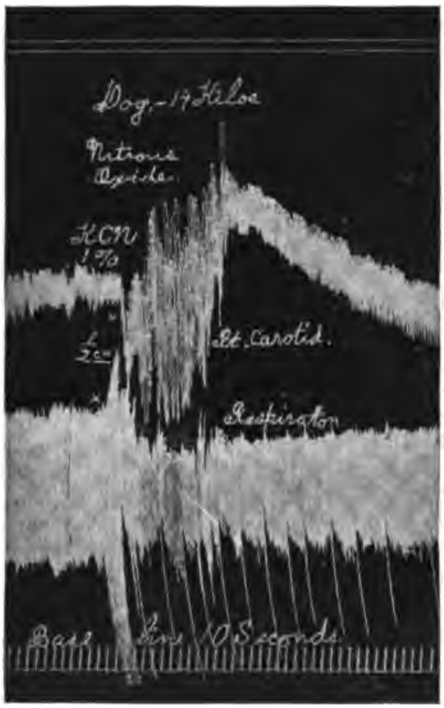

Fig. 9.—Dog anesthetized with nitrous oxide. At the point indicated ½ c.c. of 1% KCN was injected intravenously. The vagi were intact. (For discussion, see text.)

to and fro from a bag in which the gas (plus the desired amount of oxygen) was contained at an increased pressure above that of the atmosphere caused an increase in the depth of the narcosis produced. (This was an entirely different principle from that which Paul Bert[12] and later Claude Martin[13] used in which the patient or animal was placed in an air-tight room, the air pressure in which was raised one-fourth above that of the atmosphere after which 80% N_2O plus 20% oxygen was administered to the patient or animal.) I have tried to verify Van Arsdale's results many times. In some cases (with dogs) increasing the pressure of the gas in the bag does deepen the anesthesia, but in many other cases I have not been able to demonstrate any advantage from this increased pressure.

Perhaps the increased respiratory exertion, the marked hindrance to the pulmonary circulation and the attendant obstruction of gaseous exchange in the lungs were sufficient in many cases to overcome the advantages of the increase in absorption of the N_2O which the raised pressure might bring about.

The intravenous injection of adrenaline in an animal under nitrous oxide anesthesia gives a practically normal reaction, i.e., the record is almost exactly like that produced by adrenaline in an animal under ether. The rise in pressure here probably supplies more oxygen to the brain and whatever asphyxia may have been present from the administration of the nitrous oxide is thereby reduced. (See Fig. 8.) On the other hand, the injection of cyanides (which are supposed to cause an internal asphyxia by lessening the tissue oxidations through inhibiting ferment action) causes a markedly increased reaction both as regards the respiration and the circulation. The animal also shows a more marked convulsive reaction than it does under ether. (See Fig. 9.) I have controlled this

Fig. 10.—Dog anesthetized with nitrous oxide. The tracing shows the blood pressure (Rt. carotid) and the bladder contractions (up-stroke). At the point indicated 1 c.c. of tetramethylammoniumchloride was injected intravenously. The animal had previously received 1½ mgs. of atropine.

by anesthetizing the animal first with N_2O and obtaining records of the blood pressure and respiration from the cyanides and then giving the animal ether, after which more records were obtained.

The motor areas are much more sensitive under nitrous oxide than under ether. One can easily secure very extensive movements of the muscles of the opposite side and can readily pick out the areas for individual groups of muscles. I have observed that dogs under nitrous oxide anesthesia may not well withstand extensive operations, particularly if the abdomen is opened and the viscera manipulated in any way.

In several respects there is a striking similarity between the effects of nitrous

oxide and those of morphine in dogs. Among these may be mentioned the production of Cheyne-Stokes respiration. This is generally present in prolonged anesthesia in dogs. The irritability of the cord is also much less depressed than is the case with the methane series of anesthetics and this action also closely resembles that of morphine. As under morphine defecation also sometimes occurs, but I have generally been inclined to attribute this to asphyxia, although other factors may be involved. A peculiar feature is often noticed in the fact that the dogs, while lying quietly and apparently fairly well anesthetized, may be aroused and waked up by stimulation or shaking in a manner very similar to that possible under a moderate dose of morphine. When thus aroused there is also often observed a marked acceleration and increase in strength of the heart beat. If the animal be again left alone it will soon return into the somnolent, or perhaps analgesic state, very much as occurs after morphine. It is difficult to study the analgesic effect of nitrous oxide separately and apart from the pro-

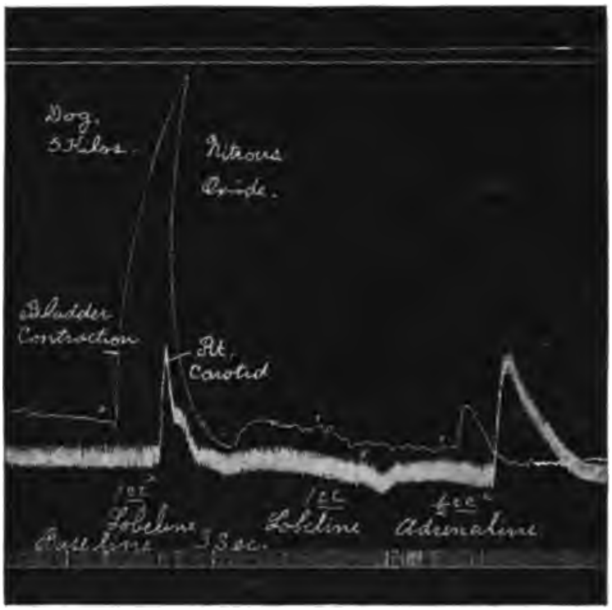

Fig. 11.—Dog under nitrous oxide anesthesia. Bladder contractions (up-stroke) and blood pressure. At the point indicated (on the left) 1 c.c. of lobeline was given intravenously. A marked contraction of the bladder and a small rise in blood pressure were produced. A little later a second dose of 1 c.c. of lobeline was given. Almost no results were produced by this, showing that the first dose of lobeline had produced ganglionic paralysis. Later a small dose (½ c.c.) of adrenaline was injected. This gave a slight bladder contraction and a small rise in blood pressure.

duction of total unconsciousness in dogs, for these animals, so long as they are conscious, are very likely to struggle and try to escape even though they feel no pain whatsoever.

The thought has occurred to me many times that nitrous oxide might be used as a hypnotic. By ordinary methods of administration this is obviously impractical. But by a slight modification of the apparatus which I have used I am inclined to believe this idea might be very well put into practice. I have tried repeatedly to compare the mild on-coming effects of the gas as breathed with a considerable proportion of oxygen with the physical and mental sensations pres-

ent as one begins to fall asleep. There is a very striking similarity, a marked feeling of tiredness and exhaustion, the limbs feel heavy and the eyelids tend to close. One's mentality gradually sinks and there is difficulty in maintaining connected thought. The natural inclination of the subject of the experiment is to lie down quietly and fall asleep. The sensations remind one of the feelings of a child worn out by a long day's play when it lies down at night to sleep. Sometimes I have noted slight muscular twitchings or feeble jumping or convulsive movements. These would probably not occur if the gas were administered very slowly with plenty of oxygen and a sufficiently long period of time were used to bring on the action of the drug. Suggestion appears to play a noticeable part in this action, for if one keeps perfectly quiet and at rest and tries to go to sleep, then the somnolent action of the gas is especially liable to be well marked. It would appear that this matter of suggestion extends even to dogs. For an animal which is petted and induced to lie down quietly and at complete rest may very often take the gas readily and peacefully fall asleep.

BIBLIOGRAPHY.

[1]Jackson, D. E.: Jour. Lab. and Clin. Med., 1916, i, p. 644.
[2]Jackson, D. E.: Jour. Lab. and Clin. Med., 1915, i, p. 1.
[3]Henderson, Yandell: Jour. Amer. Med. Assn., 1914, April 11, p. 1133.
Also Douglas, C. G.: Literature in the Ergebnisse der Physiologie, 1914, xiv, p. 338.
[4]Kemp, George: Brit. Med. Jour., 1897, ii, p. 1480.
[5]Hewitt, F. W.: "Anesthetics and Their Administration," London, 1912, p. 312.
[6]*See* Robinson, G. Canby: "Transient Auricular Fibrillation in a Healthy Man Following Hydrogen Sulphide Poisoning," Jour. Amer. Med. Assn., 1916, May 20, p. 1611.
See also Willett and Tyrrell (2 cases): The Lancet, London, 1902, March 29, p. 897. In both of these cases I suspect cardiac irregularities were present.
[7]Henderson, Yandell: Jour. Amer. Med. Assn., 1914, April 11, p. 1134.
[8]Haldane, J. S., and Poulton, E. P.: Jour. Physiology, 1908, xxxvii, p. 401.
[9]*See* Gwathney: "Anesthesia," New York, 1914, p. 127.
Brunn: "Die Allgemeinnarkose," Stuttgart, 1913, p. 327.
[10]Hewitt, Sir Frederic W.: "Anesthetics," London, 1912, p. 91.
[11]Van Arsdale, William Waldo: Amer. Jour. Med. Sc., 1891, cii, p. 142.
[12]Bert, Paul: Comptes rendus, 1879, lxxxvii, No. 20, p. 728. *Also* xcvi, p. 1271.
[13]Martin, Claude: Comptes rendus, 1888, cvi, p. 290. *Also* L'Union Médicale, 3 sér, 45, 1888.

THE HISTORY OF ORTHODONTIA

By Bernhard Wolf Weinberger, D.D.S., New York City.

(*Continued from page 509.*)

JOHN TOMES (1847) in *"Dental Physiology and Surgery"* illustrates "The Upper and Lower Jaws, with the *full complement* of finely developed teeth," and states:

"The reason for assuming that in these cases the permanent were kept back by the temporary teeth is, that the crown of the former is received between the fangs of the latter, and therefore cannot come through without the previous removal of the superimposed tooth. Again, irregularity in time seldom occurs to the same degree in any of the more anterior teeth, which, when the temporary teeth remain after the usual time for rejection, appear either anterior or posterior to them."

"Another cause of irregularity in the time of eruption of the adult teeth,

arises from insufficient space in the jaw, from defective growth. The canine teeth are retarded from this cause more frequently than any other teeth, arising from the canine being last to be cut, and the space being occupied by the incisors and bicuspids which have been previously evolved. I have seen several specimens of this—one on the table—in which the canine tooth, from want of space, has been developed, but remained deep in the jaw, completely imbedded in the bone, the crown resting between the fangs of the lateral incisor and the first bicuspids. Nature, in these cases, has fitted the teeth for their peculiar position by developing an extremely short fang."

"Today I shall bring to your notice the various deviations from the normal arrangement of the teeth. You have been told that the front teeth (by which I mean the incisor and canines) with the bicuspids, occupy in the well formed jaw a semi-circle, and that the molars extend backward from the two ends of the semi-circle, in slightly diverging lines; thus forming together an elliptic curve. In this curve the tooth projects before or recedes behind the neighboring teeth. Such is the normal arrangement of the perfectly developed teeth in well formed jaws. Instead, however, of the teeth presenting this even and uninterrupted line, we occasionally find that one or more teeth are placed either external or internal to the line, the teeth themselves being at the same time individually well formed. In the normal position each tooth has its anterior and posterior, or speaking more correctly, its buccal and lingual surfaces, placed at right angles to the radius of the curve which it contributes to form; but a tooth may be twisted on its axis, and have these surfaces, anteriorly and posteriorly, and thus constitute a form of abnormal position. Mr. Saunders in his lectures before referred to, speaks of a case in which a front tooth was twisted half way round, so that the proper lingual surface was anterior. In the normal arrangement, the anterior teeth of the upper close over in front of the corresponding teeth of the under jaw. In some cases, however, from malposition of the teeth, or from want of a proper ratio in the growth of the upper and lower jaw, the upper teeth close posterior to those of the lower jaw—a condition commonly denominated 'underhung.' "

"Instead of the under teeth closing anterior to the upper, we find in some instances that they close upon the cutting edges of the upper teeth, which constitutes another form of irregularity, though partaking of the same character as the preceding form."

"A third form of abnormal position occurs where the front teeth do not come together at all, a space of variable width separating them when the mouth is closed."

"The causes of abnormal position of the teeth are almost exclusively of a mechanical nature and may be divided into four classes. First, want of sufficient room in the alveolar arch for regular arrangement. Secondly, abnormal position during development, as regards the fangs of the preceding temporary teeth. Thirdly, non-absorption of the fangs of the milk teeth. Fourthly, a more rapid growth in the one jaw than in the other producing undue prominence of the teeth or abnormal development of the jaw."

"If malformation of the jaw be the cause there is but little hope of remedy; if the jaws are too small to admit of the natural arrangement of the teeth, but are

otherwise well formed, then we may by the judicious application of mechanical means, with which I shall presently make you acquainted, reduce the teeth to their normal position."

"Treatment.—When we see how much can be done by orthopædic surgery in restoring crooked and deformed limbs to the natural form, whether the patient be middle aged or young, we should at once conclude, even without the aid of experience, that much might be done to remedy irregularity in the arrangement of the teeth, and we should become more certain of our point when we observe that if the molar teeth from age or accident be lost, the under incisor, closing against the posterior inclined surfaces of the upper incisor, slowly but surely force the latter outwards."

"The treatment, then, mainly consists in applying steady uniform pressure upon the irregular tooth in the direction of the place you wish the tooth to occupy."

"What has been said of irregularity in the position of the front teeth applied generally to irregularity of the bicuspids, as also to the molars, though the latter are less frequently subject to the irregularities in position, and when it does oc-

Fig. 1.

Fig. 2.

Fig. 1.—"A plate for a fixed point, from which to reduce to order irregular teeth, represented in situ." Made of ivory. (John Tomes. 1848.)

Fig. 2.—"Vulcanite plate for drawing inwards the front teeth; the thin elastic band of gold is tightened by means of the nut shown on the right of the figure." (John Tomes.)

cur, the degree is very slight, amounting, except in rare cases, to nothing more than the one standing a little out, and the next little in, thus forming a zigzag line."

Complete Irregularity in the Front Teeth.—"It can scarcely happen that we have irregularity in the teeth of one jaw without a corresponding irregularity in the teeth of the other jaw; the one following as a consequence of the other."

"The most common abnormal position occurs in these cases where the upper teeth, on closing the mouth, pass behind those of the under jaw."

"This form of malposition of the teeth may arise from several causes. Thus the under jaw and teeth may be developed more rapidly than the upper. The incisors of the under jaw usually appear before those of the upper jaw, and take their position internal to the temporary teeth, which at the time are usually loose and quickly fall out, and then the succeeding teeth come forward and occupy their places."

"A third cause of the posterior position of the front teeth of the upper jaw may arise in the permanent teeth of the under jaw, coming through anteriorly

to the temporary teeth, so that the upper teeth, closing behind them, tend to force them still further outwards."

"*Treatment.*—The causes of the reversal of the relative position of the front teeth of the two jaws you have seen is purely mechanical, and the defect is maintained by a mechanical cause. Our treatment must therefore be mechanical also. The first we have to do is to prevent the front teeth from closing and thus preventing them from exercising any influence upon each other. This is effected by placing caps of metal or ivory upon the masticating surface of the molars of the upper jaw, of such a thickness that when the mouth is closed the front teeth no longer meet. Having attained this point, a steady uniform pressure must be directed against the posterior surface of the misplaced teeth, and continued till, on removing the caps upon the molars the upper teeth are found to close in their position; the position having been once gained is retained by action of the under teeth upon the inclined posterior surfaces of the upper teeth."

"There are three methods of applying the pressure to force the teeth outwards. In one a fixed point is gained by fitting a piece of ivory to the hard palate and the surfaces of the necks of the teeth, to which it is tied so as to prevent the possibility of motion; pieces of dry compressed wood are then interposed between the ivory and the necks of the teeth you wish to be moved outwards. The wood on absorbing moisture swells and as the fitted ivory cannot be moved backwards the teeth are necessarily moved forwards; after the wood has remained about eight and forty hours it should be removed and a piece of fresh wood put in its place, which on swelling forces the teeth still further outwards. The renewal of the wood is repeated till th teeth have assumed the required position; the ivory is then removed from the palate and the caps from the teeth, and the process is allowed to be completed by the action of the upper and under teeth upon each other, the under forcing the upper outwards, and the upper pressing the under inwards till the molar comes in contact, when the front teeth assume their permanent place."

"In the second method the fixed point is made anterior to the teeth, and is accomplished in the following manner. Caps, as in the former case, are fixed to the molar teeth, from thence a strong piece of flattened gold or silver wire is made to pass in front of the teeth. Opposite each tooth the wire is perforated with one or two holes, through which a ligature of silk is passed round the neck of the tooth; the silk is then tied tightly to the wire. The teeth by the action of the silk are dragged outwards. The ligatures require to be tightened and removed from time to time till the teeth have assumed the required position, when the appartus is removed. Instead of silk, the vulcanized India-rubber is frequently used. The third method of treatment consists in fitting metal to the surface of the front teeth of the lower jaw. The plate is continued upwards above the edge of the teeth, but instead of proceeding in the same line, is turned inwards, so that on an attempt to close the mouth the piece of metal passes behind the teeth of the upper jaw, and presenting an inclined plane, forces them outwards."

"The success of the methods of treatment will be greatly enhanced by capping the molar teeth."

"Of the three forms of treatment, I have described to you I much prefer the

first, being more easy of application, more rapid in its effects, and less troublesome to the patient than the two succeeding methods."

"A second form of complete irregularity of front teeth is when the upper and lower close upon each other."

"The treatment necessary for the reduction of this irregularity is precisely similar to that required in the treatment of the 'under lining.'"

"However, in these cases, if attention is directed to the subject early, the simple pressure by the thumbs of the upper teeth outwards, will, in many cases, with a little care and perseverance, place the teeth in their proper relative position, especially if frequent attempts be made to place the under teeth in drawing back the teeth of the under jaw behind those of the upper jaw."

"A third malposition of the front teeth occurs in an excessive prominence of the upper set. The front teeth press into the lips, are constantly exposed, and when the mouth is closed rest upon the under lip. This form of irregularity is more or less connected with the defective development of the superior maxilla. The alveolar process is developed at a considerable angle with the general surface of the face, and the edge embracing the necks of the teeth is therefore very prominent. This prominence might arise from several causes. Thus the permanent teeth might come down in front instead of behind the temporary teeth and their alveoli, and supposing the milk teeth to be presented a little beyond the usual period would at once tend to the deformity in question."

"Again, if the incisors are long, and the molar teeth short, the under incisors on the mouth being closed, will, instead of resting upon the basal edge of the upper teeth, press down the inclination of the ridge and finally get fairly behind the teeth, and with their edges against the surface of the gums. We often see this state produced when, from age or some other cause the molars and bicuspids are lost.

"*Treatment.*—The first thing to be done towards remedying this evil is to remove one or two bicuspid teeth, so that space may be gained for bringing the teeth inward, which may then be effected by pressure inward, the fixed point being either external to the teeth in the form of a band of metal, or internal to the teeth in the form of a piece of ivory fitted to the palate."

"There is a fourth form of complete irregularity of the front teeth. The alveolar lines of the jaws are developed at such an angle with each other that on closing the mouth, the molar teeth alone come in contact, the front teeth being separated to a considerable interval. If the defect in formation be discovered early in life, some attempt at restoration should be made by continued pressure under the chin, but if the deformity is found in the adult, the less you interfere the better, as your patient will have overcome by habit the inconveniences arising from malformation."

"Whichever of the anterior teeth be the subject of malposition the same modes of treatment for the reduction of the irregularity are applicable. If, then, the front teeth are found, on examining the gums, to be out of position the cause of the irregularity should be sought."

"If there is a want of space, one or more of the temporary teeth should be removed, and the patient should be directed to press the tooth frequently during the day towards the proper situation. The required position may, in some

cases where the irregularity is slight, be given the new tooth by the frequent use of a piece of wood shaped something like the handle of a spoon. The bent part should be passed behind the inward tooth, and the mouth partially closed, when the projecting portion of the instrument should be pressed downwards towards the chin. The under teeth will then form the fulcrum, and the upper tooth will be moved outwards. If the under teeth stand too much inwards the action of the lever may be reversed, and the upper teeth made the fulcrum."

"Our first step in the treatment must, therefore, be to remove the influence of the opposing teeth by placing caps on the molars, which will so heighten them that on closing the mouth the front teeth do not come in contact."

"Having accomplished this point, and ascertained that there is sufficient space in the proper situation, steady pressure must be made upon the irregular teeth. If one tooth only be displaced it may be sufficient to pass an elastic ligature behind or before (as the case may require) the irregular tooth, and then round the adjoining teeth, in such a manner that the ligature shall exercise a

Fig. 3.—Metal plate with two elastic bands of gold soldered to the back part of the plate, the free ends pressing upon the teeth. In the sketch below, the manner of adjusting the wire bands for the retention of the plate is shown.

tractile force upon the tooth in the direction in which it should move. The best material for elastic ligatures is vulcanized caoutchouc."

"If, however, the irregular teeth are well grown, the treatment by elastic ligatures may occupy in inconvenient time, and it will be better at once to construct a plate fitting the palate, and thus gain a fixed point."

J. B. Mitchell, in his paper on the *"Management of Irregular Dentition,"* published in 1847 in the *"American Journal of Dental Science,"* has the following to say:

"Irregularity of the second dentition, viewed in regard to its cause is of two kinds; the one arising from a want of harmony between the development of the permanent set, and the decadence of the milk teeth, the other depnding on a defect in the correspondence which ought to exist between the growth of the jaws and the increased volume of the second series of teeth."

"That species of irregular dentition, however, which depends on the disproportion between the capacity of the jaws and the size of the teeth, forms the subject of several conflicting opinions. Two principal views have been taken by dentists, the distinguishing features of which are, on the one side, a tendency

to allow things to take their course until remedial measures are called for, and, on the other, a leaning to preventive means."

"In the system which is based on the former view, reliance is almost exclusively placed on the natural expansion of the jaws during the second dentition—no decisive measure being adopted till after that period has elapsed, when, if room cannot be provided in the dental arch for the irregular teeth, by artificial means, they must be extracted."

"The fundamental errors of this system are its temporizing nature and the sacrifices that are entailed by the delaying of the treatment. In the first species

Fig. 4.

of irregularity, this delay is rather to be commended than condemned, but, in that kind of irregularity which arises from disproportion between the size of the teeth and the development of the jaws, I should consider the sacrificing of one of the permanent incisors or canine teeth as little better than no treatment at all, or at least not such as one would expect from the superintendence of a professional man."

W. Rogers, in 1847, following Robinson. He declared that he was very much against ligatures. He also condemned the use of plates, level planes, rods, pivots, hooks or hinges. He asserted that there are no defects in regulation which could not be done away with, so long as the patient is still young; he even says that many cases come about successfully at the age of thirty.

For his own method of regulation, he procured the necessary room for the

teeth, first, by filling the sides of the teeth to be regulated; second, by widening the arches of the alveoli; and third, by extracting either one or both small back teeth of the jaw bone. He recommended the latter procedure, for he believed that the teeth become straightened almost by themselves. For material for apparatus he used only gold, for it possesses more elasticity than all other metals; for ligatures he used silk.

For the treatment of irregularity he made use of his own "Regulator" which

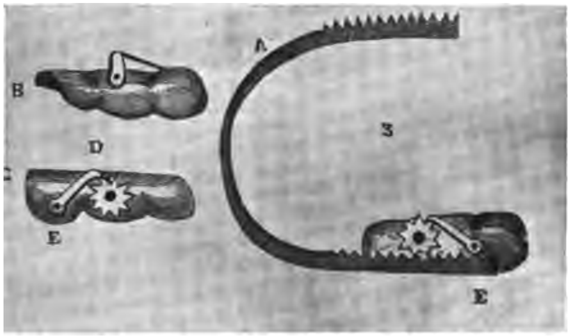

Fig. 5.—Type of appliance as used by Wm. Rogers. 1845.

he claims is simple, good-looking and effective in all cases. It consisted of three distinct parts. The first part was indented on both sides, semi-circle in shape and joined together by two metal shells, which were fastened upon both molars and served as a fulcrum. The indented part fitted in the shells by means of a

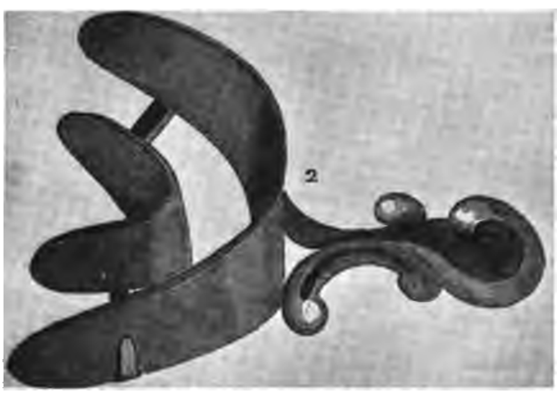

Fig. 6.—Form of one of the impression trays used by Wm. Rogers.

shell, which turned around by means of a watch-key, and which was fastened with a thread hook.

S. P. Hulihen, American Journal of Dental Science (1849), was perhaps the first to advocate a surgical procedure in extreme cases of protrusion of the mandible. This idea was later suggested by Ottolengui (*Dental Cosmos,* 1897, p. 143); by Whipple (*Dental Cosmos,* 1898, p. 552); and by Angle (*Dental Cosmos,* 1898, p. 635). Owing to the age and the extreme protrusion of the jaw, it was decided that the ordinary method of procedure for its correction

would not be effective, and that a surgical operation should be resorted to,—the removal of a section of bone from the body of the jaw and alveolar process in the bicuspid region on each side of the arch.

"To remove the projection of the under jaw seemed to require the first attention. Unless that could be done, the other operations, however successful, would add but little if any to the personal appearance of the patient. This lengthening of the jaw had taken place entirely between the cuspidatus and first bicuspid tooth of the right side, and between the first and second bicuspids of the left. By this elongation, the teeth just described were separated on both sides about three-fourths of an inch. To saw out the upper edge of these elongated portions of the jaw, and then to divide that part of the jaw in front of the spaces thus made, by sawing it through in a horizontal manner, so as to permit the upper and detached portion to be set back in its proper and original position, appeared to be the only possible way of remedying the deformity. This plan I therefore adopted, and performed the operation on the 12th day of June, in the manner now to be described."

"The operation was commenced by sawing out, in a V-shape, the elongated portions, together with the first bicuspid on the left side, each section extending about three-fourths of the way through the jaw. I then introduced a bistoury at the lower point of the space from which the section was removed on the right side, and pushed it through the soft parts, close to and in front of the jaw, until it came out at the lower point of the space on the left side. The bistoury was then withdrawn, and a slender saw introduced in the same place, and the upper three-fourths of the jaw, containing the six front teeth, was sawed off on a horizontal line ending at the bottom of the spaces before mentioned, the detached portions being still connected, on the outer and inner sides, to the jaw below, by the soft parts. After having, with the bone-nippers, removed from the detached portion the corners which were created by the horizontal and perpendicular cuts of the same, it was set back so that the edges, from which the V-shaped sections were removed, came together."

E. G. Tucker (*American Journal of Dental Science,* 1850) soon after the introduction of elastic rubber, conceived the idea of using the resistance of same for moving teeth. Although elastic rubber had been used prior to his time, he decided to make use of it in the form of tubing, cut into thin pieces, as rubber bands.

"To prevent disease is far more important than to cure it, both on the score of expense and comfort. This is, perhaps, a truth more applicable to our profession than any other."

"The removal of a tooth in the child may secure regularity, prevent premature decay, and thus ward off the pain and destruction that is sure to visit the adult tooth."

"Parents, therefore, cannot begin too soon to watch the growth of their children's teeth, and to seek the aid of the dentist. They should realize that this advice is not given for the purpose of increasing the labors of the dentist, but to lessen them. If he does more for the girl, he will be called upon to do less for the lady, and if he performs his duty to the boy, there may be no occasion for calling him to the man."

"The business of regulating teeth is new to most people, and yet, when we consider to what expense some are willing to go for comfort, convenience and appearance, it must become, in time, a very important branch of our profession."

"I have been led to suppose that something might be contrived as a substitute for spiral springs, gold bands, etc. I have made, for experience, rubber tubes of different sizes and thicknesses, so that rings may be cut of any dimensions. No substance that I can think of would be more likely to prove pleasant to the mouth, or less likely to irritate the tender parts; besides, by these tubes, we may have a great variety of means, as to power, in the simplest and cheapest form. We can commence with a small force and increase, or reverse the operation, according to the circumstances of the case."

"The frame-work, made of silver or gold, may be prepared with hooks or clasps at different parts of the plate, so as to attend the loops with ease, by the use of two instruments, such as pluggers, stretching from tooth to tooth, whether near or remote. It is easy to conceive of a variety of operations with these pulling rings, and to you it is quite unnecessary to enlarge."

Dr. Wm. Dwinelle (1849). The jack-screw for the correction of irregularities of the teeth is thought to have been introduced by Dr. William Dwinelle about the year 1849. He first made it of gold, but later used steel on account of its greater strength. He discovered that by placing a small amount of zinc in a hole in the end of the screw device its oxidation was prevented.

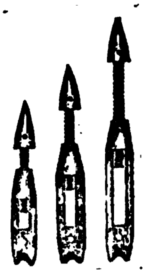

Fig. 7.
The jack-screw.
Wm. H. Dwinelle.

It seems strange that so important an appliance as the jack-screw should have been brought to the attention of the profession on both sides of the Atlantic during the same year. Who deserves the credit will never be settled, but to both Drs. Dwinelle and Gaines, of London, honor must be given for the above appliance. In *Johnston's "Dental Miscellany"* for 1877, we find the statement where he claims priority to the use of this method.

"Hitherto most of the instruments used by our profession for regulating teeth, of necessity, were composed of the superior metals, such as gold, platinum or silver; they being so soft in their quality, to make them strong enough to resist the force required for all practical use involved their being made so large and clumsy that they usually defeated their purpose, or compelled us to be satisfied with only a partial success. Here, then, was an opportunity to construct the smallest as well as most powerful instrument of steel, to be placed in the mouth with impunity. You had only to drill a hole in the steel and plug it with zinc, to give it the same immunity from oxidation as gold or platinum. A moment's reflection selected the jack-screw as the most powerful instrument, in proportion to its size, known in mechanics. Within a few hours I had a number of them made, from a quarter to over an inch in length, with various terminating points or ends, and with interchanging screws and nuts, some of which I have in use to this day, and all of which have ever been free from rust. It is only necessary to replenish the zinc, as it wastes away by oxidation, to keep them in order and ensure them from rust."

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID MCCOY, D.D.S., EDITOR,
LOS ANGELES, CALIF.

A CONSIDERATION OF SOME OF THE FACTORS INVOLVED IN THE INTERPRETATION OF DENTAL AND ORAL RADIOGRAPHS*

BY JAMES DAVID MCCOY, D.D.S.,
Professor of Orthodontia and Radiography, College of Dentistry, University of Southern California.

NOT infrequently we hear the assertion made by members of the dental profession that only minor importance should be attached to the findings of the x-ray, their claim being that the radiograph can be construed as showing almost anything whether the condition actually exists or not.

Such an attitude can be explained as being the outgrowth of several things, among which a lack of knowledge of the fundamental principles of radiography and its various branches, and especially of the science of interpretation, stands as an important factor. Therefore opinions of the x-ray and its application in dentistry expressed by those unqualified, should not be regarded seriously.

The idea also seems to prevail among the dental profession that the interpretation of radiographs is an extremely simple matter, requiring little if any preparation on the part of the one who is to make the interpretation. This erroneous idea is doubtless responsible not only for many errors being committed, but also for a lack of greater appreciation by the profession of the value of the radiograph.

The first requisite of interpretation is an accurate knowledge of the anatomy and physiology of the structures involved, for a radiograph is a shadow picture, and a shadow picture is meaningless unless one is thoroughly familiar with the main characteristics of the original.

The radiograph may be said to vary from an ordinary shadow picture, as in addition to mere outlines, varying densities are shown due to the fact that the x-ray penetrates all matter in inverse ratio to its mass or density.

If one is possessed of an accurate knowledge of the anatomy and physiology of the dental and oral structures, the next step toward acquiring the ability to correctly interpret radiographs of these structures, would be *to become familiar with their radiographic appearance under normal conditions,* for unless one be familiar with the appearance in the radiograph of the structures under normal

*Read before the Southern California Dental Association, June 20, 1916.

conditions, it would be obviously impossible to intelligently recognize pathological or anomalous conditions unless they were of a glaring nature.

When we speak of the radiographic appearance of the structures under normal conditions, we refer not only to a freedom from pathological or anomalous involvement, but also to the character of the radiograph itself, which must be normal in that *it must be made in accordance with a technic, which results in the shadows of the structures under scrutiny being imposed upon the plate or film in their correct proportions.*

Therefore, it is essential that in addition to the before mentioned requisites, *one who would intelligently interpret radiographs must understand enough of the fundamental rules of radiographic technic to know when examining a radiograph, whether or not the technic involved in its making was correct or faulty, and if faulty, whether or not the degree of fault is sufficient to render it so inaccurate as to be useless.*

In correctly made radiographs, the dental and oral structures under normal conditions have a characteristic appearance, for owing to the varying densities

Fig. 1-*A*.

Fig. 1-*B*.

Fig. 1.—The radiographic appearance of the teeth and their surrounding structures under normal conditions are here shown. *A*. Upper bicuspids and molars. *B*. Lower molars. The color spectacle is, of course, reversed from what it would be if the original radiograph was under observation.

of the contained structures in our field, they appear upon the plate or film in a manner most advantageous for observation. For instance, it will be noted upon the examination of such a radiograph, that metallic fillings if they are present, appear as white masses, and root fillings as somewhat less dense lines. The enamel and dentine are next in density, while root canals show plainly as dark channels in the dentine, and the alveolar process and maxillæ show their fine uniform cancellous structures in various degrees of density, depending upon their thickness. (See Fig. 1.)

In examining a radiograph, it is essential that the original plate or film only be used, and this should be examined carefully and in a proper light, if the maximum amount of information is to be obtained from it.

This is best accomplished by utilizing some sort of illuminating box or cabinet from which varied degrees of light are obtainable. The face of such a cabinet should be covered with ground glass, so that the light transmitted will be equally distributed and free from shadows. As a radiograph is a transparency, a dim light behind it will bring out one set of shadows to their greatest clear-

ness. An increase in the light will show forth still other effects; while a high degree of illumination will bring out the more dense portions.

In this manner each portion of the radiograph may be studied under a degree of light destined to bring out the maximum amount of detail.

Now with a "print" or "lantern slide" one can study the field only from a one light aspect and oftentimes in order to secure any detail in the lighter or less dense areas, it will be found that the dense areas must be printed almost to an inky blackness. This fact accounts for the unsatisfactory appearance of many radiographs used as illustrations in our journals, for when reduced to half tone engravings much of their valuable detail is lost.

Fig. 2.—A cuspid tooth lying against the anterior wall of the antrum. It will be noted that the cuspid is inverted in its position.

If one be unfamiliar with the fundamental rules of radiographic technic, they cannot know when examining a radiograph just what portions of it are to be relied upon to give dependable information, for as a rule, owing to the anatomic arrangement of the structures in our field, only limited areas can be relied upon to be "in focus" in each radiograph. But if one is possessed of an accurate knowledge of the anatomy and physiology of the parts involved, understands the fundamental rules of radiographic technic, and is familiar with the appearance in the radiograph of the dental and oral structures under normal conditions, *it should by no means be difficult to see any alterations or changes, which occur in these structures as a result of anomalous or pathological conditions.*

The mere ability to note *an alteration or change* in the structures does not fulfill the requirements of intelligent interpretation, for *these alterations or changes* can have their full significance only to one *who understands the pathological conditions which may develop in these structures, and the character of the anatomical changes which they bring about.* Therefore, it should be apparent that the ability to intelligently interpret radiographs is not a thing to be acquired over night, but must come as the result of study in several important branches, and any one who attempts it otherwise assumes responsibilities unworthily.

Assuming that you are familiar with the appearance in the radiograph of the dental structure under normal conditions, let us consider some of the changes to be found in the presence of anomalous and pathological conditions.

Fig. 3.—The presence in or absence from the jaws of successors of the deciduous teeth can easily be determined, as well as the state of development of any unerupted teeth.

As a tooth is much more dense than the bony structures of the jaw or adjacent parts, any anomaly of form, size, or position, is easily discernible even though it occupy a position far from what might be expected; as for instance, in the case of impacted molars, teeth in the antrum, etc. (See Fig. 2.)

Likewise, and for the same reason, the presence in or absence from the jaws of successors of the deciduous teeth can easily be determined, as well as the state of development of any unerupted tooth. (Figs. 3 and 4.)

Fractured roots or fractures of the bone even without displacement, are often discernible at the line of fracture, owing to the fact that the line of fracture offers less resistance to the penetration of the rays, and therefore is apparent upon the plate as a dark line.

In examining radiographs, we should bear in mind the fact that very dense tissues are characterized by white areas, while less dense tissues appear darker, and the absence of tissue is indicated by blackness. To avoid confusion, we should remember that in prints and lantern slides, this color spectacle is reversed.

One of the most characteristic alterations or changes in the tissues to be noted in the radiograph, is that to be found where an alveolar abscess is present. We know that when such an abscess takes place there is always an accompanying destruction of the cancellous bone tissue at the immediate seat of the inflammatory process. Knowing that the absence of tissue is indicated in the radiograph by

Fig. 4.—An unerupted upper cuspid lying in contact with the root of the central. An attachment has been secured to the cuspid and it is being moved down.

Fig. 5.—The characteristic appearance of a large alveolar abscess is here shown.

Fig. 6.—A large abscess is shown at the apex of the upper second bicuspid. Likewise upon close examination, an abscess is also shown at the apex of the first bicuspid. Notwithstanding the fact that this one is small, it should be regarded with the same concern as the large one.

a dark or black area, such an area if located at the apex of a devitalized tooth, or about a root or fragment of a root, would indicate the presence of an alveolar abscess. In fact, where these dark areas are found in the alveolar process, *and are not natural cavities*, such as the antrii, or the nasal cavities, or such well defined nerve openings as the mental foramina, and where they are *markedly* circumscribed, that is, having a distinct and abrupt line of demarcation between the dark area and its surrounding tissue, we can in nearly every case, even if a clinical history be lacking, make the positive diagnosis of alveolar abscess. (See Fig. 5.)

Not infrequently, dentists are prone to disregard such evidence, as these areas are often to be found about the apecies of teeth giving no inflammatory symptoms. However, in the light of our present knowledge of these conditions, we know that this fact no longer carries weight, nor is it worthy of special consideration. The fact remains, as indicated in the radiograph, that a change has taken place in the structures, and such changes occur only as a result of the presence of an inflammatory process. (Fig. 6.) Furthermore, it has been demonstrated that when such inflammatory processes are really eliminated, the cancellous tissues involved will again regain their normal character. (See Fig. 7—A, B, C.)

Alveolar abscesses do not by any means present a "stereotyped" appearance in the radiograph, but vary greatly in size. For this reason, the smaller ones may sometimes be overlooked, or not be regarded seriously by those lacking the requisites of intelligent interpretation. Likewise, these small abscesses

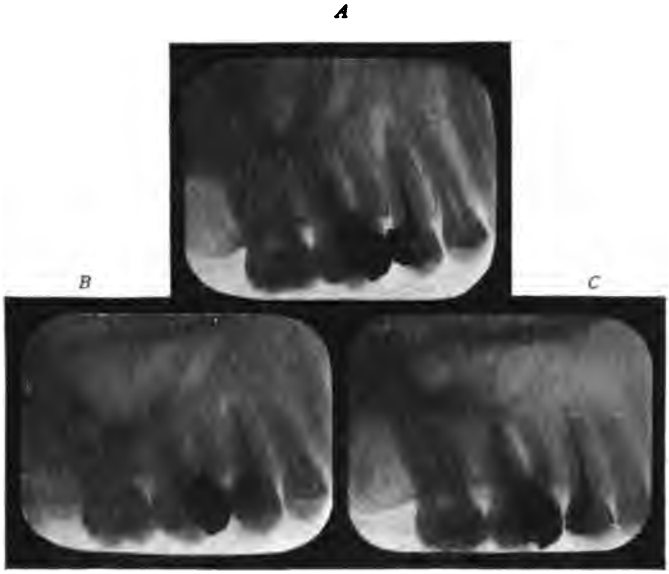

Fig. 7.—*A*, An upper bicuspid tooth with an alveolar abscess at its root apex. It will be noted that the root canal is incompletely filled.

B, The same tooth about two months after it had been treated and the root canal properly filled. The rarefied area about the apex has greatly decreased in size.

C, Shows the same tooth about six weeks later. The rarefied area has entirely disappeared and the bone structure about the apex appears to be normal.

may sometimes not be apparent in the radiograph as a result of the employment of incorrect technic in the exposure of the plate or film. (Fig. 8.)

Necrosis likewise appears upon the plate as a dark area, but differs in a characteristic way from the ordinary alveolar abscess in that it is not circumscribed, *namely, that there is not a distinct and abrupt line of demarcation between the dark area and its surrounding tissue,* as is the case with the circumscribed infections, but *the area gradually shades off from dark into light,* portraying the progressive characteristics of this disease. (See Fig. 9.)

The different filling materials vary but little in relative graduation of density, and when used as root filling materials, are plainly visible as light lines. Because they differ in density from cementum and dentine, the extent to which

they have been introduced into the root canals is easily discernible. (See Fig. 7, A, B, C.) Broken-off broaches and other instruments, or small wires introduced into root canals to determine their length or the extent to which they have been opened, because of their great density, appear very white and are easily differentiated from root-canal fillings or tooth structure.

Fig. 8.—Small abscesses are shown at the apexes of two upper bicuspid teeth. If in making this radiograph the images of the teeth had been lengthened as the result of incorrect technic, these areas would not be discernible.

Fig. 9.—A necrotic area about roots of an upper central and lateral.

Fig. 10.—Characteristic appearance of the enveloping tissue about the upper bicuspids and molars in a well developed case of pyorrhea alveolaris. Compare the condition shown here with that shown in Fig. 1, *A* and *B*.

Fig. 11.—A destructive process in progress about a lower first bicuspid.

Fig. 12.—A hypercementosis is shown at the apical third of an upper lateral incisor. Also a deep pocket extending up the mesial side of the root terminating in an abscess area. Notwithstanding the fact that this condition had been present for months, the lateral was still vital at the time the radiograph was made.

Where a destructive process has ensued in the peridental membrane, or in the bony wall of the alveolus (pyorrhea pockets) and is present on the mesial or distal side of a tooth, these conditions appear upon the plate as dark areas owing to the fact that the rays pass through them more easily, and effect the emulsion of the plate to a greater degree than if normal bone structure is present. The approximate extent of the destructive process is therefore easily determined. (Figs. 10, 11, 12.)

Cysts and tumors of the maxilla or mandible, owing to the fact that the

Fig. 13.—An osteo-sarcoma of the mandible.

character of the changes they bring about renders the areas involved less dense, their extent is visible upon the plate as a dark area. (Fig. 13.)

In seeking out the various anomalies and pathological conditions to which the teeth and oral structures are subject, *we should not be misled by indefinite shadows upon the x-ray plates.* The very nature of these structures, their gross as well as minute anatomy, renders them somewhat difficult to radiograph, and necessitates a refinement of technic greater than that demanded with most of the other portions of the human anatomy. *Therefore, only radiographs made in accordance with a definite and exacting technic should be relied upon for diagnosis. If a doubt exists in any given instance, an additional or even several more exposures should be made, so that any conclusions reached will be founded upon definite evidence.*

SOME INSTANCES IN THE PRACTICE OF ORAL SURGERY WHERE THE X-RAY HAS BEEN OF GREAT VALUE

By Emil Francis Tholen, D.D.S., M.D., Los Angeles, Calif.

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The time has arrived when the x-ray is essential for good scientific work in oral surgery. This means that every one of us is obliged to know the interpretation of radiographs. While it is true that many radiographs give negative findings, yet this is often of valuable aid in arriving at a diagnosis by exclusion. However, we have our greatest aid in cases where the radiograph confirms and clears our physical findings. So much valuable aid has been derived that I wish to report a few cases with illustrations.

Miss C. 20 years. Displaced unerupted cuspid which is crowding lateral and central out of line. Deciduous cuspid in place. (See Fig. 1.) Refuses operation.

Mr. M. For six years was troubled with a chronic infection and fistula of the right upper jaw with frequent acute exacerbations. Had curetment and an

Fig. 1.

Fig. 2.

extraction without result. Radiographs showed extensive necrosis. (See Fig. 2.) It extended from the right upper central to the first molar and involved the right nares. The area was exposed from the canine fossa and thoroughly curetted. Recovered.

Mrs. L. Pain and cramping sensation in right side of face for four years. The only etiological factor was a piece of root surrounded by very dense bone and located just above the right mental foramen. (See Fig. 3-A.) I had to take repeated films in order to locate and remove it. (See Figs. 3, B and C.) Last report showed patient to be much improved.

Miss R. Fractured right upper lateral eighteen years ago. Had curetment and first root amputation during this interval without improvement. Examination and x-ray show a cyst over the left lateral containing gutta-percha.

Fig. 3-A.

Fig. 3-B.

Fig. 3-C.

Fig. 4.

Fig. 5.

Fig. 6.

(See Fig. 4.) A re-amputation of the root was done and cyst wall entirely removed. Complete recovery.

Mrs. T. Case of chronic apical abscess. (See Fig. 5.) Root amputation. Radiograph two months after root amputation. (See Fig. 6.)

Mrs. K. Neuralgia pains and soreness of left upper jaw, lasting two years. Had various teeth extracted and antrum treated without relief. Antrum exploration was negative. Radiograph showed a piece of broach in root canal.

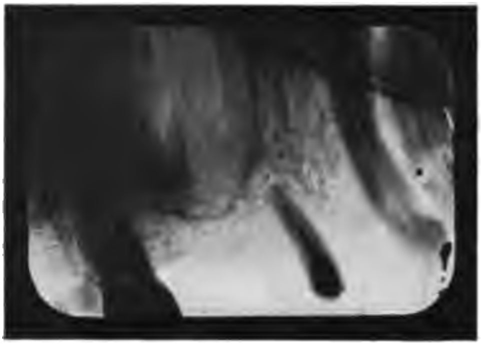

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

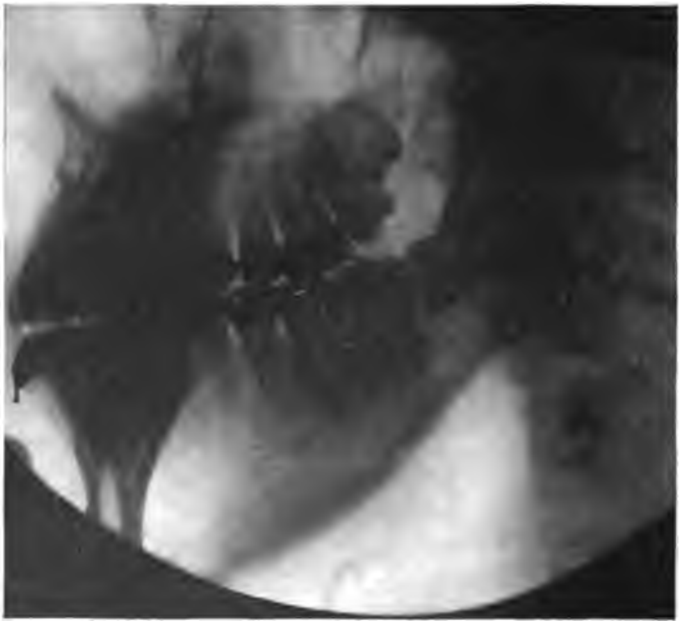

Fig. 11.

(See Fig. 7.) I was unable to remove the broach, therefore extracted tooth and curetted. Complete recovery.

Mrs. E. History. Symptoms of left antrum disease for three years. Radiograph shows cloudy antrum and chronic abscesses of upper right first molar. (See Fig. 8.) Exploration showed pus. Tooth was extracted, antrum drained for two weeks. Recovered.

F. C. J. Hospital patient. Anemia due to pyorrhea and pus pockets and apical abscesses. (See Figs. 9 and 10.) Extracted all teeth except four. The remaining teeth were given prophylactic treatment. Six weeks later, patient very much improved and able to leave the hospital.

Mr. E. Case of severe ulcerated stomatitis with trismis, resulting from infection from impacted lower third molar. (See Fig. 11.) Tooth extracted. Complete recovery.

Fig. 12.

Miss H. Chronic arthritis for six years. Numerous focal lesions in mouth. Mention this case to illustrate fractured root with rarefied bone. (See Fig. 12.) Treatment just begun.

In cases of dislocation of mandible I have never had occasion to use the x-ray as all were easily reduced. However, there may come a time when the x-ray will be of great value.

In fractures we always make a radiograph before and after reduction and as indications arise.

I take many more radiographs as a result of having an x-ray laboratory in connection with my office than I would otherwise, and find it of much value both in the saving of time and in obtaining the best of results

CURRENT ORTHODONTIC LITERATURE

Edited by H. C. Pollock, D.D.S.

Some New Forms of Orthodontic Mechanism

DR. E. H. ANGLE (*Dental Cosmos,* September, 1916) announces a new form of appliance and in this paper the difficulties involved in the use of the Angle Pin Tube Appliance are taken up. The need and demand for a modification of the original pin tube appliance is pointed out and a detailed description is given of the appliance, which it is believed will meet the requirements in which the pin tube appliance is lacking.

The subject of injudicious extraction of teeth is also discussed and the error of this former practice is called to mind. This discussion leads up to the establishing of normal function and correlated parts. He maintains that "On this basis only can orthodontic treatment be permanently beneficial and truly satisfactory for such only is in accordance with nature, and this is the true meaning of orthodontia."

Leading up to the appliance, however, other subjects are taken up which establish the principle upon which the appliance is based. Indications for early treatment of malocclusion is urged although a warning is issued against the needless interference with child dentures now so often practiced.

As to the physiologic application of force, the modern idea is presented as advocated in previous work by Noyes and Oppenheim as being the ideal force to be desired, and with this end in view, the improved appliance should operate in such a physiologic way as to meet such requirements. They should move teeth slowly, by slow, gentle force continuously applied which will not only move teeth far more rapidly than the great force, but does not inhibit the normal cellular activity as has been demonstrated to be true in using great force.

After describing in detail the technique of the new appliance, the advantages of the new device are summed up as follows:

"Force may be so controlled as to permit or to prevent the tipping of any tooth or teeth to any extent, or to compel the bodily movement of any tooth or teeth in either or both arches.

"This mechanism is of the greatest simplicity, of the maximum delicacy of parts, and with all unnecessary material eliminated. Hence it is of the least inconvenience to patients and the easiest to keep cleansed. It would seem that the mechanism is nearly ideal, not only for securing the necessary static force for anchorage and of dynamic force for tooth movement, but for directing and controlling this force so that all cellular change attending on tooth movement most nearly accords with the laws of physiology. It is also graceful in its proportions and not unpleasing in appearance. In a word, the principles of mechanics, art, and physiology do not conflict, but are made to harmonize beautifully and as was never possible in orthodontic mechanism before. It is so simple and easy to apply as greatly to lessen the usual work of the orthodontist

and the usual number of visits of patients. It is not expected that it will wholly supersede the pin and tube mechanism, neither will it wholly supplant the expansion arch in its round form with ligature attachments. In fact, the ligature attachment will be found to be of advantage in connection with the ribbon arch in the movement of premolars and of other teeth that may be so pronouncedly misplaced as to render impracticable the bending of the ribbon arch to gain bracket attachment with them until after they have first been moved into more favorable positions by means of ligatures. But in the great majority of cases the mechanism herein shown will be found to possess such obvious advantages in force control and in ease of application and operation, that I believe it will find a permanent place in orthodontia."

A few cases are shown which according to the author have been successfully treated by Ketcham, Gough, Strang, and Mendell, as well as those of the author.

The Teeth in Rickets

IN a recent article J. Lawson Dick, M.D. (*British Journal of Dental Science,* August, 1916) states that in an examination of 1000 London school children of Jewish descent, 80 per cent showed distinct evidence of rickets. They were examined to show the relationship between nutrition and rickets.

Of the 386 rickety cases in which a record of permanent teeth could be taken, 42 per cent had normal teeth, and 28 per cent had defective teeth. 20 per cent of these showed hypoplasia frequently combined with decay, and 38 per cent had decayed teeth. This is not equivalent to saying that 42 per cent of school children have normal teeth. The records were taken at about the age of 12 or 13 years.

Of the cases with carious teeth the lower first molar was decayed in 80 per cent, the upper first molar was decayed in 30 per cent, and one or more premolars in 12.5 per cent.

The incisors, canines, and second molars were seldom decayed. The fact that the lower first molar decay is more prevalent is attributed rather to the main part of the enamel of the crown having been laid down in the first two years of life when rickety conditions are operative.

Dr. Dick says many of the conditions conducive to rickets are present in the parents of these children and *a priori* it might be expected that this would frequently be a congenital defect. He points out, however, that rickets is not a congenital condition and is another evidence of the care that nature takes that whatever else suffers the germ is at least protected during the intrauterine life.

A later form of hypoplasia is every now and then seen in which the two premolars and the second molars are affected, whilst the incisors, canines and first molars are not affected. This later form of hypoplasia must be due to influences acting on the child from the second to the sixth year. Association has been recognized between lamellar cataract and hypoplastic teeth. Mr. Norman Bennett collected twenty-two cases of lamellar cataract, all of which showed well-defined hypoplasia in the permanent teeth, and in thirteen cases there was a history of convulsions whilst teething.

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EDITORIALS

The Proceedings of the American Society of Orthodontists

IN view of the fact that the Board of Censors of the American Society of Orthodontists at its last meeting in July at Pittsburgh voted down the proposition made by the editors of the *International Journal of Orthodontia* to publish the proceedings of the Society, and in justice to those members who were unable to attend the Pittsburgh meeting, we want to take this opportunity to state the facts in the case.

We have always believed that the proceedings of the American Society of Orthodontists would better serve the interests of everyone concerned by being published in the *International Journal of Orthodontia,* which is published for the members of the dental profession who are interested in orthodontia, and for the benefit of humanity by furthering orthodontia so that the dental profession may be able to render better service to the public.

It is a fact that cannot be disputed that the proceedings of the American Society of Orthodontists as published in *Items of Interest* have appeared over

a period of months after each meeting, which is to say the least very detrimental and a disadvantage to the members who do not attend the meetings.

At the present time, the membership of the American Society is something less than eighty, and out of this number about thirty members were in attendance at Pittsburgh. While it is true that more men attended the meeting at Pittsburgh than the thirty active members of the society, yet the only vote which came up that showed a test of the membership was the vote in regard to the proposition as to whether the American Society should publish their proceedings in the *International Journal of Orthodontia.* On this proposition there were just twenty-nine votes cast, two members not voting. Therefore it is safe to say that about a third of the members attend the annual meetings. Consequently it appears to us that it would be a decided advantage if some plan could be perfected whereby the other two-thirds who have paid dues for a number of years and have continued to support the Society in a financial way, would be given some consideration in regard to the publication of the proceedings. The statement was made at Pittsburgh that the absent members should not be shown consideration, because, if they were interested, they would attend the meeting. It seems to us that any one who is willing to pay his annual dues of five dollars is somewhat interested in orthodontia, and is at least entitled to more of a hearing than he was given at Pittsburgh.

In fairness to those absent members who were in favor of our proposition, we will say we still believe that the *International Journal of Orthodontia* could serve the interest of all of the members of the American Society of Orthodontists better than *Items of Interest.* Of course, we will agree that we could probably not serve the interest of a few as well as our esteemed contemporary, but a few should not dominate the other three-fourths of the Society.

We are criticized for making the campaign open and above board to obtain the proceedings, for it seems to be a standard among some men both in national and dental politics that anything which is done in a political way should be done under cover. For the benefit of those opposed to our policy, we will therefore make the statement at this time that we still insist that the proceedings of the Society should be published in a journal devoted to orthodontia, and we will bend every effort towards accomplishing that purpose, and the purpose will be accomplished openly and above board.

We were called unethical and undignified by certain members of the American Society because we insisted upon asking for the proceedings, and they even went so far as to tell us that we had no right to ask for them inasmuch as they had been published so long by *Items of Interest.* As an equal argument, we might say that a man has no right to buy an automobile because his father rode in an ox cart. If there is to be no progress in any branch of orthodontia, then there should be no progress in the publication of the proceedings.

If dental journals and dental literature are to remain the same as they were twenty years ago, if there is to be no advancement made in the dental profession, or in orthodontic science, then we say leave things as they are because they have always been that way.

The argument was also made that, owing to the fact that *Items of Interest* has a larger circulation than the *International Journal of Orthodontia,* the pa-

pers of the society would be given more publicity, and it would be of more benefit to the men who wrote the papers by having them receive that publicity than if they were published in the *International Journal of Orthodontia.* Again you have the question of personal ambition entering into the argument. In other words, the man who wrote the paper did not write it for the advancement of orthodontia, but for his own personal advancement, and believes that his personal interest would be served better by having the paper published in a trade journal with a wide circulation.

If circulation is the thing desired, we might suggest that the proceedings of the American Society of Orthodontists be published in the Saturday Evening Post, The Ladies Home Journal, or some other magazine which has a larger circulation than any dental journal published at the present time.

We take this opportunity to express our gratitude to the members of the American Society of Orthodontia who were unable to attend the meeting but supported us in our endeavor to secure the proceedings. We wish to assure them that their interests are our interests regardless of what a few may say, and that as long as the *International Journal of Orthodontia* is published, regardless of the fact that some few may consider us "unethical and undignified," we will be striving for the advancement of orthodontia in such a manner as to do the greatest good for the dental profession and the public, and therefore, will always be striving to obtain the proceedings of the American Society so that they may be published in a manner to serve the greatest number of men interested in orthodontia in the shortest possible length of time.

A Plea for More Careful Consideration of Scientific Subjects Before Orthodontic Societies

IT is our observation that papers on scientific subjects do not receive the consideration they merit when presented before orthodontic societies. Any paper which does not deal with some phase of mechanics receives very little consideration or discussion. There is no question that mechanics plays an important part in orthodontia, but there are problems which require more attention and which must be considered before orthodontia can take its place among the real sciences.

We need only to call attention to four papers which were presented before the American Society of Orthodontists at Pittsburgh in July. All of these papers were read by members of the Society, but two of them were on scientific subjects which required much time to prepare and a great amount of search through the literature to collect the data presented. The others dealing with mechanical problems were also excellent papers and probably required considerable labor to prepare. The papers on the mechanical subjects were well presented and much time was given to their discussion, but it does seem rather unfortunate that so little attention should be given to the scientific papers presented.

We refer particularly to the papers presented by Dr. O. W. White and

Dr. B. W. Weinberger. The paper by Dr. White discussed cell metabolistic problems, a subject that should be of more than ordinary interest to every orthodontist. Dr. White's paper was undoubtedly one of the best presentations of the question dealing with the general cell metabolism as related to malocclusions ever rendered, one that required considerable time and labor to prepare, and out of justice to the essayist should have been discussed by at least some of the members present. Yet there was practically no discussion of this paper, due principally to the fact that so few men were prepared to discuss such a subject.

The paper by Dr. Weinberger deals with the question of prenatal influences on the production of malocclusion, or the mesio- or disto-clusion of the mandible as a result of constitutional or general conditions. This is a problem that has been much discussed in the past, but we have never before heard the subject so accurately and scientifically presented. As in the case of the paper by Dr. White so also here was there no attempt at discussion.

We simply recall these instances to show the tendency of the American Society of Orthodontists, which is not only the trend of orthodontists but also that of the dental profession as a whole. We hope that the day is not far distant when the orthodontic profession, and in fact the entire dental profession, will awaken to the need of a more definite scientific knowledge and come to the realization that they can not devote all of their time in programs at meetings to the discussion of elementary subjects if they ever expect to elevate the profession to the highest possible plane in the scientific world.

We trust that in the future the Board of Censors will attempt to have men on the program who can and will discuss papers of a scientific nature, and when papers similar to those presented by Drs. White and Weinberger are read, there will be at least four or five men in the audience who are capable of making an intelligent discussion of the subject.

The Crimes of Orthodontia

THOSE who have been engaged in the practice of orthodontia for a number of years and are so situated that they come in close contact with the members of the dental profession and have heard the discussions of dentists at various dental society meetings, might be led to believe that orthodontia has inflicted a great many crimes upon the public and forced a great many ills upon the dental profession. We know of men in the dental profession, unfortunately occupying prominent positions, who are very greatly opposed to the correction of malocclusion of the teeth. Much of this opposition seems to be because of selfish motives, which is, however, an element too small to be worthy of consideration. There is another side of the question with which we are confronted that must be met squarely. We find men who are condemning the treatment of malocclusion upon the argument that the regulating appliance causes the decay of the teeth. We find them going so far that, when they see a patient who has had a regulating appliance upon his teeth, they claim every cavity in the teeth, regardless of where

it is located, has been produced by the regulating appliance. They are talking this so strongly to their patients that people are discouraged from having malocclusions treated, because they have been told that the regulating appliance will decay the teeth. These same men forget that the greater part of their practice consists of filling the teeth of patients who have never had a regulating appliance in their mouth. In other words, since teeth decay which have never been in malocclusion and teeth decay which have never had an appliance on them, why then should they not be expected to decay when they do have the appliance on? We have seen cavities in the occlusal surfaces of the molars which have developed because of fissures, and they have been attributed to the regulating appliances, which, of course, was entirely wrong. We have also seen, in the practice of the same men who are condemning the treatment of malocclusion, fillings, crowns, and bridges, which are far from perfect, and which could be very easily condemned and criticized if one was inclined to do so. In fact, taking the case as a whole, there are probably more failures as the result of faulty dental operations in the dental profession than there are decayed teeth or failures in the practice of orthodontia. regardless of what plan or method has been pursued.

It is our belief that the percentage of failures in the treatment of malocclusion is smaller than the percentage of failures in any other line of dental or medical work. However, as we have said before, there is a question of "crime" laid at the door of orthodontia, which must be met, and that is that in certain cases the decay of the teeth has been produced by the regulating appliance. The problem of modern orthodontia then is to eliminate the cases of decay which have been produced by the appliance, but these cases are by no means as great in number as many dental practitioners would have us believe. In fact, the decay of the teeth can be absolutely controlled, providing the case be treated with that idea in view, or by using the knowledge that we have at the present time. It is an absolute fact that in the hands of orthodontists who use removable regulating appliances the decay of the teeth is practically nothing.

When fixed appliances are used, it is found that the decay of the teeth is limited to those who employ the noble metals. Gold and platinum and iridioplatinum, without the question of a doubt, have no antiseptic properties, and the tooth in contact with such a metal is very liable to decay. The decay of the teeth will necessarily have to be controlled by the constructioin of appliances in such a manner that they can be cleaned, which is taken care of in the removable appliance; if the fixed appliance is used, it should be made from some metal or substance which is antiseptic and prohibits growth of acid-forming organisms. This can be done by the use of such metals as contain an alloy of zinc or copper, which metals are being used quite satisfactorily at the present time. It is absolutely wrong for the orthodontist to become wedded to one particular metal or insist on using nothing but noble metals, when as a matter of fact, the dental profession is proving through observation that the use of the noble metals invites decay. It is much better to use a metal which does not look so well in the mouth, which may oxidize occasionally, which has been classed as the base metal, and which has a known antiseptic property, in preference to a metal which is known to produce decay and the resulting crimes which are laid at the door of orthodontia by the members of the dental profession who are as a rule opposed to specialization any-

way. As stated before, there are not as many decayed teeth resulting from the use of orthodontic appliances as some would have us believe, but we do believe that there is entirely too many at the present time. There is hope in the future that orthodontists will do much more than they have in the past towards eliminating the decay of the teeth, thereby removing the possibility of criticism by certain men who are accusing orthodontia of a crime, when it is really not its fault.

The Appellate Court Decision of the Taggart Inlay Case

IT has been some time since the question arose in the dental profession as regards the validity of the Taggart inlay patent. Many practitioners who were formerly friends have become enemies over this question, and while, as a whole, it has affected orthodontia very little, nevertheless it is a question which has a much more important bearing upon orthodontia than some would imagine. While we have no personal interest in the matter one way or the other, never having made an inlay in our life by the Taggart Process, we consequently cannot be accused of some of the motives others have been accused of. However, we believe that orthodontists and the dental profession as a whole should have a clear conception of the scope of the Taggart case, and what the latest decision means.

On June 13, 1916, the United States Circuit Court of Appeals for the Seventh Circuit granted a decision that Dr. Taggart could not undertake to enforce his claim by bringing suit against the dentists jointly or collectively. This question has a great deal of bearing upon further suits which might be filed, but has no bearing upon the validity or scope of the Taggart Process Patents, which were not involved in this decision. The court simply decided that Dr. Taggart did not have a right to sue dentists collectively in a single suit, and was brought before the Court of Appeals as the result of the following conditions:

About three years ago, Dr. Taggart's attorney began sending letters to the dentists of Chicago and northern Illinois, demanding that they pay $150 in five days, and threatening to commence an infringement suit if they failed to comply. Separate suits were immediately begun against a number of dentists. As a resut of such suits, the Dentists Mutual Protective Alliance was organized, and its attorneys undertook the defense of the members against whom the separate suits had been brought. Some against whom the suits had been filed settled according to Dr. Taggart's suggestions. Dr. Taggart then abandoned his separate suits against those who would not settle, and brought a single suit against scores of dentists adding to that suit from month to month. Finally, after 523 defendants had been brought into one suit, Judge K. M. Landis, of the United States District Court, before whom the case was pending, ordered that Dr. Taggart should join no more dentists as defendants. When this collective suit came to trial in June, 1915, the first question to be raised was that of Dr. Taggart's right to deprive each man of his day in court by suing all jointly. Upon this question, Judge F. A. Geiger, before whom the matter was tried, held that there was an improper joinder as to all of the defendants save one.

The trial then proceeded as to the one defendant selected by Dr. Taggart and twelve others selected and volunteered by the Alliance in order to secure

a series of test cases in which every possible question as to the merits of Dr. Taggart's patents and his claims of infringement might be finally determined. These test cases are still pending in the District Court of Chicago, and are in no way affected by the decision of June 13.

The scope of the decision of June 13 decided Dr. Taggart can not maintain a single suit against dentists collectively, and it was upon this phase, a this phase alone, that the court of appeals has just rendered the decision.

There is nothing in this decision which will prevent Dr. Taggart from filing suits against individual dentists, but it will prevent him from filing a joint suit against a large number of dentists in one locality. Owing to the large amount of trouble to which a number of men have been placed because of these process patents, we hope that the Dental Alliance will succeed in securing a sufficient membership to enable them to give a thorough defense of each test case, and decide the question as to the validity of the process patent for always.

Sixtieth Anniversary Meeting of the St. Louis Dental Society

TO appropriately celebrate the sixtieth anniversary of the St. Louis Dental Society, which has been in continuous activity since 1856, a program of exceptional excellence is being prepared for the week of November 16, 1916.

The St. Louis dentists intend to make this occasion an important event in the dental history of the country, and one which shall eclipse in interest and attendance all former efforts of local societies.

As a fitting tribute to Black, McKellops, Forbes, Morrison, Spalding, and others who founded and maintained this society in the pioneer days of the profession, the anniversary will portray the advance of dentistry from that epoch-making period resulting from the organization of societies.

A series of scientific papers along the advanced lines of present interest will disclose some amazing knowledge from research work now progressing under the supervision of the foremost teachers and original investigators. A national representation of individual clinicians and co-operative clinics by societies and technic clubs will supply a most complete course of practical instruction.

This is the meeting you will hear more about, and will regret if you miss. Additional information will be published as the time approaches, and invitations will solicit the representation of all societies. For the convenience of visitors from a distance the literary and clinical program will be limited to three days—November 16, 17, 18, 1916.

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ORIGINAL ARTICLES

THE LINGUAL ARCH IN COMBINATION WITH THE LABIAL ARCH WITH EXTENSIONS AS USED BY DR. LLOYD S. LOURIE

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ARCHES or alignment wires are known to the orthodontic profession either as labial or lingual arches. Orthodontists are familiar with the ordinary labial arch, also known as the expansion arch, which consists of a piece of metal threaded at both ends. However, the lingual arch was introduced later and is manufactured in various types. The lingual arch which I will attempt to describe in this paper as used by Dr. Lloyd S. Lourie, of Chicago, is worthy of special attention because of its compactness and esthetic value. This lingual arch has been evolved from the old retaining appliance, which consisted of bands upon the canines with a wire lingual to the incisors soldered to the canine bands.

This form of lingual retaining device was described by Angle in the sixth edition of his book on "Malocclusion of the Teeth." When this form of retaining device was used, rubber plates were employed for the retention of the molars and premolars. Some time before 1905 Lourie began using a lingual arch, the ends of which extended back to the bands on the molars. This lingual arch was made from a piece of wire which had been made to fit the lingual surfaces of the teeth, by soldering tubes on the distal end to slip over the screws of the ordinary molar clamp band on the "D" band as described by Angle. This was used for the retention of cases when it was found necessary to discontinue treatment during the summer vacation period.

It was found by using the wire stretchers and by making bends in the lingual arch that a certain amount of tooth movement could be accomplished without readjusting the ordinary expansion arch, which could be very easily adjusted because the clasp bands would still be in position with the buccal tubes. Lourie

used this form of the lingual arch as a retaining device for several years before he demonstrated it at a clinic at the Chicago meeting of the American Society of Orthodontists in 1905.

While using the lingual arch as a retaining appliance and being able to accomplish certain movements by using the wire stretchers and by bending the lingual arch, it appealed to him very much as a possible regulating device. He also found that such teeth as required rotation could be rotated as satisfactorily by using ligatures and bands in conjunction with the lingual arch as when the labial arch was used. By the use of either the labial or lingual arch alone with bands and ligatures, root movement can be controlled. He therefore began the use of the labial arch with the extensions which made possible root movement with the use of the bands, and consequently gave us a labial appliance which was less conspicuous than anything we have had heretofore. Owing to the fact that the labial arch has always been conspicuous, it is recommended in those cases where the lingual arch alone can be used because of its inconspicuousness and its esthetic advantages. This is sufficient to recommend its use in all possible cases. In fact, after seeing a number of Lourie's patients and examining a large number of models of cases which he has treated by using the lingual arch, I am of the opinion that the possibilities of the lingual arch with the small labial arch are limited only by the skill and ability of the operator. Another advantage of the lingual arch as compared with the ordinary expansion arch is that the appliance necessarily is shorter and can be made of smaller gauge without danger of displacement due to springing and bending. The shorter the distance between the point of the anchorage and the moving of the malposed tooth, the smaller the appliance can be in diameter. There is a limit to the small gauge and size of the labial arch especially if there is a great distance between the points of attachment. The small-gauged labial arch can be used if it is attached between the anchorage and the moving teeth. It must be remembered, however, that if there are many points of attachment and if those points are made rigid by the use of a large number of bands with some locking device, they necessarily interfere with the movement of the teeth by making a larger number of points of attachment which in turn will have some influence upon the anchor tooth, and also upon those teeth which are attached to the appliance. In using any style of the labial arch the greater the freedom of the movement or adjustment that you have upon the malposed tooth, the more satisfactory the appliance will be.

As stated before, there is a limit to the smallness of the gauge of the labial arch owing to the long span between the anchorage from the right to the left side, if the molar teeth are used as anchorage. If an attempt is made to move the incisors forward, the small-gauged labial arch, with attachments on the incisors and molars, will very often bend and spring towards the cheek and stand away from the teeth so as to cause an abrasion of the mucous membrane of the cheek. Of course this condition would not be allowed to exist very long with most operators, but I have seen it occur in a great many cases where the attempt was being made to use a small-gauged labial arch.

With a small-gauged lingual arch this bending is not apt to occur; in fact, it cannot occur because of the proximity between the lingual surfaces of the

incisors and the molars. It is possible to satisfactorily use material of a much smaller gauge for the lingual arch than for the labial arch for the same amount or type of tooth movement.

As stated before, the use of the lingual arch as employed by Lourie was evolved from the older retaining appliance which was first constructed by soldering tubes on the arch to fit the end of the screws on the molar clamp bands. The molar bands which carried buccal tubes were thus left in position and it was this buccal tube that was used with the labial arch with extensions. It was found by stretching and bending the lingual arch that a large amount of tooth movement could be accomplished and that rotation could be obtained in certain types by the use of the band and spurs.

The lingual arch in itself was not satisfactory when root movement was desired, but having the buccal tubes on the molar bands a labial wire could be used for that purpose. Such a wire is shown in Fig. 1, which is a labial arch of 17 gauge, gold and platinum, to which has been soldered four extensions projecting occlusally on the labial surface of the tooth too near the cutting edge and

Fig. 1.

thereby controlling the apical tooth movement. This labial arch when used with these extensions is adjusted so as not to come in contact with the gingivus. In fact, it is placed so far gingivally that it lays above the gingival margin of the tooth under the lip. The labial spur extensions stand away from the gum, as does the labial arch, so as not to interfere with the gingival tissue, and then touches the tooth at some point near the cutting edge. If a greater amount of the apical tooth movement is desired the spur touches the tooth near the cutting edge or may be bent over slightly to engage the incisal edge of the tooth. The labial arch is held in position either by the use of the intermaxillary rubber or by a ligature tied distal to the tube on the upper molar and in front of the intermaxillary hooks. When these labial arches are adjusted the patient is often advised that the appliance can be removed during the daytime and need be worn only at night; however, the majority of patients wear them continuously since no part of the appliance is visible except the small labial extensions. The shape of the labial arch can be maintained during the day by being placed on a form made out of modeling compound, upon which the arch is shown in Fig. 1.

As above stated, the lingual arch was first used by Lourie with a tube on the end to slip over the threaded portion of the molar clamp band. Later in his practice after the molar clamp band was discarded, a plain molar band was used in retention.

The combination of the lingual and labial arch eliminates the use of bands

on the anterior teeth. The main objection to the use of these bands is that they cause separation between the teeth so that after they are removed there is a lack of proximal contact, and during this period the tooth very often returns to its rotated position. By using a combination of the labial and lingual arches it is possible to retain rotation of the anterior teeth without destroying the proximal contact.

Formerly the mistake was made in attempting to separate the treatment period from the retention period. Retention is really a part of the treatment and very often a retaining appliance must be so constructed as to make it possible to adjust the teeth finely and delicately so as to get the proper proximal contact as well as the occlusal relations. Cases which have been shown as finished results were not really such because the model had been made immediately after the appliance had been removed and before the retaining appliances had been adjusted. A finished result is one which can be shown after the period of retention has been completed and sufficient time has elapsed to prove that the forces of occlusion are going to hold the teeth in their proper position. The great advantage of the labial and lingual arches in combination is that they allow all of the forces of occlusion to act properly. This adjusts each individual tooth with the possible exception of the two teeth carrying the anchor bands. The anchor teeth carrying the bands which hold the labial and lingual arches have not the same freedom of movement as the remainder of the teeth, and it very often happens in distoclusion and sometimes in neutroclusion that during the period of treatment the bands are removed from the first molars (at the time the retaining appliance is adjusted) to the first premolars. This allows the molars an opportunity to respond to the forces of occlusion which they have been prevented from doing because of the wearing of the molar bands during the period of treatment.

As already mentioned, Lourie first employed the lingual arch as a retaining device, then began using it as a regulating appliance, and at the present time has evolved the use of the plain lingual arch to a very high degree of efficiency. Owing to its delicacy and inconspicuousness, this lingual arch certainly has a great future in orthodontia and especially to those of us who have some consideration for esthetics and our patient's comfort. I would therefore recommend to those who are interested in the lingual arch to begin using it first as a retaining appliance, and after they have accomplished the majority of tooth movements by using it in that manner, they will be able to obtain a degree of efficiency in bending and stretching the wire that will enable them to use it as a regulating appliance.

Very little has been said regarding the attachment of the lingual arch to the bands. It must be remembered that the lingual arch can be divided into several forms, those where it is soldered to the bands and those that have some form of removable attachment; however, it is not intended here to go into the various forms of attachment as the writer hopes to be able to give the details of these attachments later on. This article was prepared more to call attention to the apparent inconspicuousness and the high degree of efficiency of this appliance when it is properly manipulated, than to go into details of construction.

Up to the present time Lourie has principally used a labial arch of gold and

platinum of 17 gauge, as shown in Fig. 1. The 17 gauge arch of gold and platinum is used because it has sufficient strength to hold the arch in its proper position. As stated before the labial arch lies above the gingivus and consequently must be of sufficient strength so that it will not be displaced during the period of tooth movement or by the action of the lips. It is possible that an iridio-platinum arch of a smaller gauge than 17 could be used. With the 17 gauge gold and platinum arch placed above the gingivus with the extension spurs as shown in Fig. 1, the appliance is very inconspicuous and in a great many instances the labial arch is removable by the patient; still very few patients remove them because there is so little annoyance or embarrassment caused by the appearance of the arch. When the bands are placed on the premolars, a labial arch of 19 gauge can be used because of the shorter distance between the premolar anchorage, and there is no danger of the arch being displaced because of the short span between the anchorage.

If intermaxillary anchorage is employed while the bands are fixed on the first molars, and after having shifted to the first premolars, spurs are attached to the first premolar for attaching the intermaxillary hook to the premolar band instead of to the labial arch, it is possible to have the hook farther occlusally. This hook attached to the band is less conspicuous than if it were attached to the labial arch, as the latter always lies above the gingivus. By having an intermaxillary hook attached occlusally to the premolar band it causes less of a downward pull and does not make as much of a leverage on the premolar as if it were attached to the labial arch.

In beginning the construction of this type of appliance the plain bands are first made upon the anchor teeth which we will presume are the first molars. Even in those cases where the lingual arch is to be used as a regulating appliance, buccal tubes are soldered on the molar band parallel with the line of occlusion for the possible use of the labial arch with the extension spurs. I have observed a number of Lourie's cases in which nothing but the lingual arch was used, but in the majority of instances, buccal tubes were adjusted on the molar bands so that it would be a very simple matter to fit a labial arch if its use should become necessary. As stated before, the attachment of the lingual arch to the molar band may be fixed or removable, each of which has some advantage. The lingual arch which is soldered to the molar band is necessarily more sensitive as the entire amount of force or adjustment falls upon some of the teeth. With a removable lingual arch there is always some play or lost motion in the point of attachment regardless of how accurately it may be fitted. On the other hand the removable arch possesses an advantage in the hands of those who have had little experience with the use of this device, because it is possible for a novice to remove the lingual arch and bend or shape it outside ot the mouth. It must be remembered, however, that the removable type is not as effective in the hands of the experienced operators as the fixed type or that type of the lingual arch soldered directly to the molar band. There might be some objection to placing a buccal tube upon an anchor band for the possible use of the labial arch owing to the fact that some would make us believe that it would be annoying to the cheek. A small 17 gauge tube on the buccal surface of the molar band properly placed and fitted causes no annoyance to the patient. These buccal tubes always

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

make it possible to employ a labial arch for a short time to assist movement which the lingual arch is not producing. If the lingual arch does not accomplish the tooth movement desired, usually the fault lies with the operator and not the appliance, because I have seen the most difficult types of tooth movement accomplished with the lingual arch and if I had not seen the case before and after treatment I would have stated that such a movement could not be accomplished with the type of appliance used.

It has been stated before that the lingual arch is very delicate and inconspicuous and may appear to some practitioners as being incapable of producing as large a variety of tooth movements as has been accomplished. We all are aware of the fact that tooth movement can be accomplished by a very delicate force, but this force should be constant in direction, and nothing is more capable of producing a force in a constant direction than a small delicate lingual arch. It must also be remembered that any appliance moves a tooth either by pushing or pulling and it seems to make no difference as to the physiological activity whether it is a pulling or pushing force.

I might mention here a few requirements of the ideal regulating appliance. We have various appliances described in the literature as being ideal, but when we analyze them carefully from a mechanical and physiological standpoint they are very often lacking in some respect. The first requisite of a regulating appliance is that it shall exert force in such a manner as to be in accord with the physiological laws, but it must not interfere with the forces of occlusion any more than possible. The large amount of damage being attributed to the use of bands at the present time should cause orthodontists to stop and consider that bands of previous years which have been considered harmless may have caused a large amount of tissue changes which develop later in life. Consequently the tendency should be toward the elimination of bands. With the use of the lingual arch and the labial arch as described in this article only two bands are necessary. It seems certain that this appliance will more nearly approach the ideal condition than any appliance that has been used heretofore.

In using the lingual arch the force is exerted by two means, either by bending the lingual arch or by use of the wire stretchers. Wire stretchers were first employed in the practice of orthodontia by Angle. The type of instrument which he placed upon the market is shown in Fig. 2. They consist of round beaks with very strong handles. By placing the beaks over the wire and squeezing the handles together an indentation is made on the wire which increases its length. These wire stretchers should possess a screw as shown in Fig. 2 to control the distance to which the handles can be closed. Lourie has modified the wire stretchers by placing a small notch near the end of the beaks which assists in centering the wire stretchers upon the wire.

Because of the large size of the Angle wire stretchers and the difficulty of getting the beaks in the proper position in the use of the lingual arch, Lourie designed a smaller instrument as shown in Fig. 3. In bending the lingual arch, especially in the fixed type, it is necessary to have a pair of pliers with which it is possible to grasp the lingual arch at right angles to the direction in which we wish to apply the force. Fig. 4 illustrates what is known as the Bogue pliers which are very useful in bending the lingual arch. They are made in two sizes,

molars near the gingival margin, which plan has been found to be productive of more or less gingival irritation. Lourie states that food lodges in between the arch and the teeth with the result that severe inflammation occurs in the gingival region. Therefore at the present time the lingual arch is bent away from the gingival portion and rests against the lingual surface of the premolars.

This case is interesting and a matter of history because it shows as far as is known the first use of the combination of the labial and lingual arch with spur extensions on the labial arch to prevent rotation of the incisors and thereby overcome the difficulties encountered in the use of bands by many orthodontists. Even if it is possible to construct the band and not have it interfere with the proximal contact we would still have the unsightly appearance of the band upon the labial surface which is much more conspicuous than small spurs resting against the labial surface of the incisors. There would also be a greater tendency for decay owing to the loosening of the bands than from the small contact of a labial spur extension against the labial surface of the tooth which is very easy to keep clean owing to the small amount of tooth surface involved.

In the next installment of this article I will take up the use of the labial and lingual arch and the treatment of certain types of malocclusion and show the efficiency, conspicuousness and delicacy of the appliances as compared to some others.

THE RESULT OF UNPHYSIOLOGICAL PRESSURE EXPRESSED IN TWO CASES

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HISTORY OF CASE.

Young lady, age 17. Open bite or infra-occlusion of the upper teeth as far back as the distal cusps of the six year molars. Arches lacking lateral development to the extent of about one-half inch. Class I mutilated, the lower left lateral having been extracted for the "straightening of teeth" at the age of ten. Upper incisors protruding, lower retruding.

ETIOLOGY.

Thumb-sucker at age of five. Habit broken by use of a solution of cayenne pepper and vinegar. Nasopharynx normal. Mouth-breather.

TREATMENT.

A description of the treatment in detail seems presumptuous as such was along the well known orthodox lines and in accordance with diagnosis. It might be mentioned that the Angle pin and tube appliance was employed on such teeth as demanded a definite root movement, and it is concerning the pin and tube in conjunction with vertical loops in arch wire, which were employed in case from Figs. 1 to 7, that I wish to emphasize.

Fig. 1.—Before treatment.

Fig. 2.—During treatment, protrusion reduced, space opened for lower lateral.

Fig. 3.—Open bite closed. Median line shifted. Elastics in region of cuspids.

Fig. 4.—Ready for retention.

Fig. 5.—Retention in place. Lower left lateral supplied with porcelain facing tacked to lingual retaining wire.

Fig. 6.—Loss of process.

It has been advised that a spring force obtained by opening the loops between two pin and tube attachments would give an ideal pressure for obtaining increased space between attachments, and to be sure, space is obtained, but the movement of teeth involved is "constantly changing" in many directions and therefore a methodical reproduction of the alveolus is impossible. It is contended by the writer that illustrations 7 and 8 clearly demonstrate the unphysiological principle as above described.

The loops in the arch were almost completely straightened in carrying cuspids laterally. The loss of process on the left cuspid (Fig. 6), is practically complete, that of right (Fig. 7), about half complete.

To quote from Angle in this regard (*Items of Interest*, Sept., 1916, pp. 992 and 993), he states the following: "the direction of force is constantly changed, thus mischievously disturbing the function of cells of the peridental

Fig. 7.—Loss of process.

Fig. 8.—Loss of process.

membrane and alveolar process, and this must be repeated with each change in the form of the loop." He further states that, "this continual pushing and pulling of the tooth backward and forward in its socket is in direct violation of the physiology of cell function, and must inevitably cause irritation, pain and absorption of tissue."

The same principle is further substantiated in Fig. 8. It will be noted that the process has been lost to the extent of about one-half of the root surface (banded tooth, right lower central). This tooth was turned, most simple to correct, yet in the course of three months it was rotated and then allowed to relapse three times, after which the tissue broke down as illustrated. No pin and tube were employed, but correction was made by a spur on the band and ligature over the arch-bar, hence again the orthodontist is impressed with the fact that his mechanical efforts must be "in accord with and wholly subservient to the physiological and physical requirements of treatment."

HISTOLOGICAL STUDIES OF THE DEVELOPMENT OF THE ALVEOLUS OF YOUNG RHESUS MONKEYS

By F. Hecker, B.S., D.D.S., A.M., M.D.

Director of Research Laboratory of the Dewey School of Orthodontia, Kansas City, Mo.

It is commonly taught in the laboratories and in the lecture room that the alveolus is dependent on the periosteum for its development and regeneration. This theory must now be set aside as incorrect, for the reason that Macewen,[1] of Scotland, has shown experimentally that the periosteum is not concerned in the development or the regeneration of bone, but that the periosteum is a limiting membrane for developing or regenerating bone. The findings of Macewen have been recently duplicated by Dobrovolskaia,[2] of Russia, in his studies of the development and the regeneration of bone. Learning these findings the orthodontist at once becomes interested, for his work is primarily with the destruction and the regeneration of bone when the teeth are moved to their correct anatomical position.

The alveolus is not laid down in its development like the bones of the forearm which are laid down in cartilage, but instead it is laid down in membrane. This being the case no transitional changes occur in a conversion of the bone cell into the cartilage cell and the osteoblast.

Careful examination of sections made from the jaw of young rhesus monkeys shows no active foci of developing alveolus along the periosteal border. The probable explanation for this is that the lateral plates of the alveolus are the first to be laid down. After they have been laid down the periosteum makes itself fast to the lateral plates and now performs the functions given it by Macewen, namely, that of a limiting membrane. This function of the periosteum prevents a thickening of the lateral plates of the alveolus and thus gives them the elasticity needed by the developing tooth, which we will take up more in detail in another part of this paper. In addition to the periosteum, we are also compelled to consider the alveolar dental ligament, for the reason that this tissue is an exact counterpart histologically of the periosteum and one of its functions is that of a limiting membrane for the alveolus which forms the root socket.

If the periosteum and the alveolar dental ligament were actually concerned in the development or the regeneration of the alveolus we would find present in the tissues in the immediate vicinity of their attachment to the alveolus, cells which morphologically are the same in type as the osteoblasts observed along the border of the developing islands of alveolus. Not finding cells of this type present we are compelled to set aside the former teaching that the periosteum and the alveolar dental ligament are concerned in the development or the regeneration of the alveolus. By the foregoing findings we are verifying the researches of Macewen and Dobrovolskaia.

[1]Macewen: The Development of Bone.

[2]Dobrovolskaia: The Regeneration and the Growth of Bone in the Test Tube. Russkiy Vrach, St. Petersburg, Vol. xv, No. 18.

The general picture presented of developing alveolus at the time of the development of the permanent tooth histologically, shows the alveolus to be very loosely constructed in its central portion while the lateral plates of the alveolus are very compact. Occasionally we observe a haversian canal or a medullary space in the substance of the lateral plates of the alveolus. Along the inner borders of the alveolus one notes many osteoblasts. The lateral plates of the alveolus are separated from the inner portion of the alveolus by long irregular medullary spaces. In the central area of the alveolus there are islands of alveolus in different stages of development which are variable in shape, size and arrangement.

Because of the loose construction of the alveolus the developing permanent tooth finds little or no resistance and its development is therefore not retarded. From this we at once realize the importance of the thinness of the lateral plates

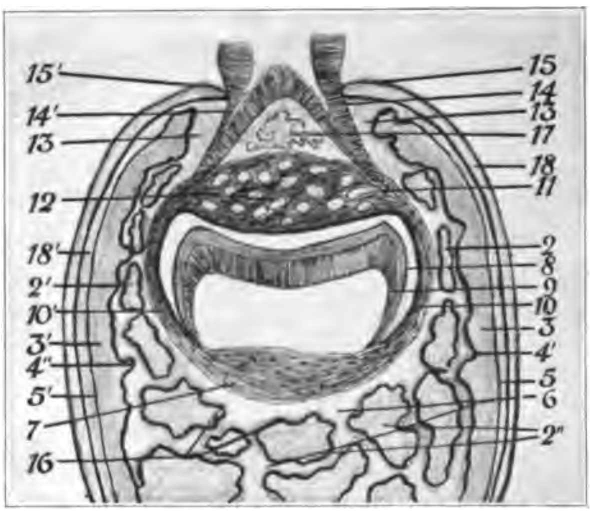

Fig. 1.—Schematic drawing showing the conical shape of the development of a superior first premolar and the relation of the alveolus and immediate dental tissue.

of the alveolus, for if the elasticity of the lateral plates was absent, the pressure consequent to the pressure created by the lateral development of the tooth would be so great that pain would inevitably occur and in addition thereto a deformed tooth. Thus we can readily see that nature has wisely provided for the future requirements by first laying down the lateral plates of the alveolus which form the matrix, the inner portion is filled with incompletely developed alveolus and roots of the developing teeth. The root of the tooth by its development causes to be produced a space which is gradually filled in by the growth of the alveolar islands.

As stated in a previous portion of this paper, as the roots of the tooth develop there is a lateral expansion of the lateral plates of the alveolus. Being unable to reduce the gross specimen or to enlarge it to such a size as would show the relation of the developing alveolus, the crown and the roots of the developing tooth and all of the dental tissues, schematic drawings were made from the gross specimens.

In Fig. 1 beginning at 15 and 15′ we have the mucosa of the gingiva; 14 is the palatine root, while 14′ is the buccal root; 13 and 13′, the alveolar dental ligament; 17, an island of alveolus lying between the palatine and the buccal roots of the deciduous tooth; 18, the mucosa; 11, the upper portion of the capsule which surrounds the crown of the permanent tooth; 12 shows round spaces which have a smooth border in the substance of the capsule which surrounds the crown of the developing tooth,—histologically these spaces are lymph spaces; 18′, the periosteum, 2 and 2′, islands of alveolus between the capsule 10 and 10′ which surrounds the developing tooth and the lateral plates of the alveolus 3 and 3′; 8, the enamel of the crown of the developing tooth; 9, the dentine of the developing tooth; 10 and 10′, the capsule surrounding the developing

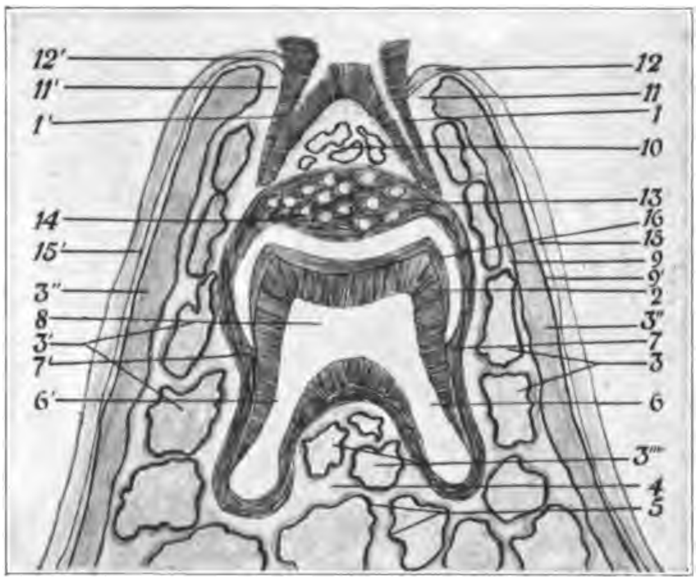

Fig. 2.—Schematic drawing showing the relation of the developing tooth and alveolus surrounding it.

tooth; 3 and 3′ the lateral plates of the alveolus; 4 and 4′, the inner borders of the lateral plates of the alveolus (it is along these borders that one observes the osteoblasts with the higher magnifications); 5 and 5′, the periosteal borders of the lateral plates of the alveolus; 6, the intermedullary spaces; 7, the lower portion of the capsule surrounding the crown of the developing tooth; 2′, island of developing alveolus; 16, the heavy borders of the developing islands of alveolus (it is also along these borders that one notes the osteoblasts with the higher magnifications).

The next schematic drawing (Fig. 2), shows the relation of the roots of the deciduous tooth, the crown of the permanent tooth, and the roots of the permanent tooth about half developed; 12 and 12′ show the mucosa at the gingiva; 11 and 11′, the alveolar dental ligament; 1, the palatine root; 1′, the buccal root; 10, small island of alveolus between the roots of the deciduous tooth; 13, the upper part of the capsule surrounding the developing tooth; 14, spaces in the substance of the capsule which histologically are lymph spaces; 15 and 15′, the

periosteum covering the lateral plates of the alveolus; 16, the enamel of the crown of the developing tooth; 9, the inner border of the lateral plates of the alveolus (with the higher magnifications no osteoblasts are noted along this border); 9′, periosteal border of the lateral plates of alveolus; 2, the dentine of the developing tooth; 3″ and 3″, the lateral plate of the alveolus; 7 and 7′, the capsule surrounding the developing tooth a short distance below the future gingiva; 8, the space which is occupied by the pulp; 3 and 3′, islands of alveolus which lie between the inner border of the lateral plates of the alveolus 9 and the capsule 7 and 7′ which surrounds the developing tooth (with the higher

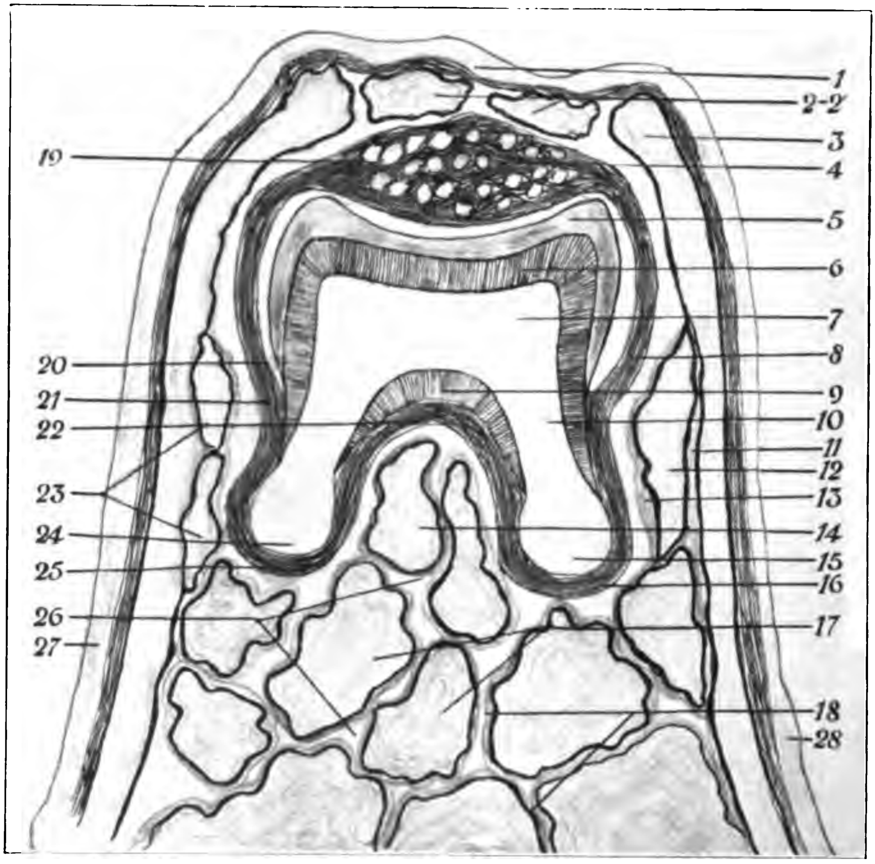

Fig. 3.—Schematic drawing showing the relation of the developing tooth and the developing alveolus of superior second molar.

magnifications we observe many osteoblasts along the border of the alveolar islands); 6 and 6′ are the future root canals of the developing root; 4 shows the intermedullary space; 5, the borders of alveolar islands along which the osteoblasts are observed.

Fig. 3 illustrates an early developmental stage of a second superior molar. 1 is the mucosa; 2 and 2′, islands of alveolus; 3, lateral plate of the alveolus; 4, the upper portion of the fibrous capsule surrounding the developing tooth; 5, the enamel of the crown of the developing tooth; 6, the dentine; 7, the pulp

of the developing tooth; 8, the fibrous capsule surrounding the developing tooth; 9, the developing dentine in the bifurcation of the roots; 10, the future root canal of the developing tooth; 11, the inner border of the lateral plate of the alveolus (along this border one notes many osteoblasts); 12, island of alveolus lying between the inner border of the lateral plate of the alveolus 11 and the capsule surrounding the developing tooth 8; 13, the border of the island of alveolus. (It is along the borders of the alveolar islands that one observes many osteoblasts); 14, island of alveolus lying between the palatine root 15 and the buccal root 25; 15, the palatine root (note the bulging of the dental pulp); 16, the capsule surrounding the developing tooth; 17, islands of alveolus; 18, borders of the alveolar islands. (It is along these borders that one notes many osteo-

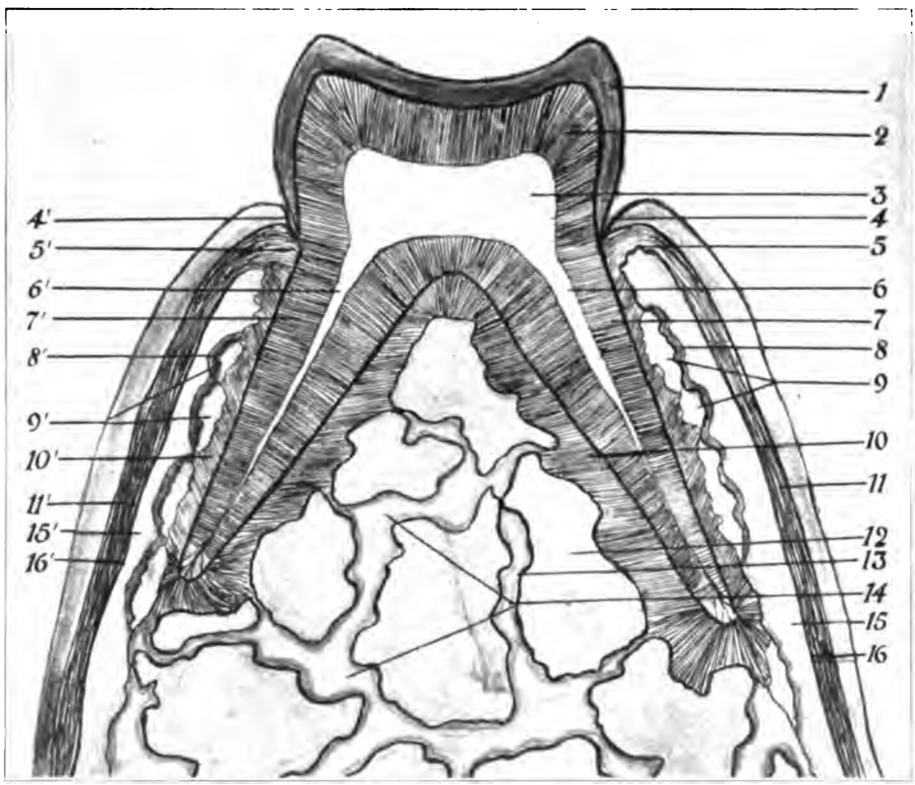

Fig. 4.—Schematic drawing showing the relation of the completely developed roots of a superior first molar and the relation of the alveolus to them.

blasts); 28, mucosa; 19, vacuolated spaces contained in the substance of the capsule which histologically are lymph spaces; 20, shows the direction of the fibrous capsule a short distance above the future gingivus; 22 shows that no union has occurred in the fibers of the capsule at this stage of the development of the tooth; 23 shows the islands of the alveolus, 24 is the buccal root; 25, the capsule surrounding the developing root; 26, the intermedullary spaces between the islands of alveolus; 27, the mucosa.

The next drawing (Fig. 4) represents a completely erupted and developed

first superior molar. 1 is the enamel; 2, the dentine; 3, the pulp; 4 and 4′, the gingiva; 5 and 5′, the alveolar dental ligament near the gingiva; 6, the palatine root; 6′, the buccal root; 7 and 7′, the dentine of the root; 8 and 8′, the inner borders of the lateral plates of the alveolus; 9 and 9′, alveolar islands lying be-

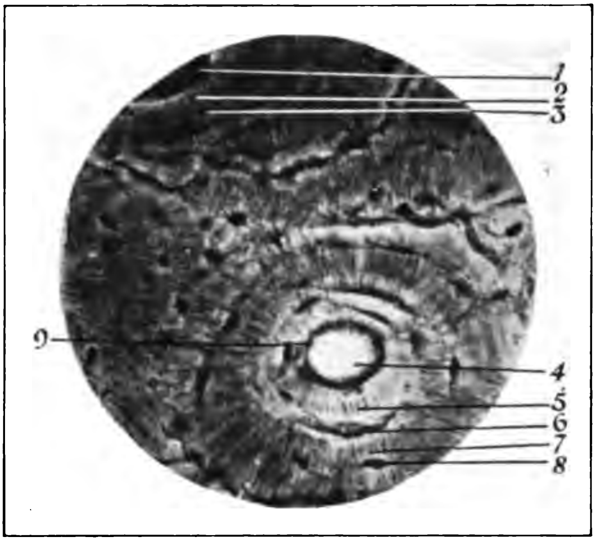

Fig. 5.—Haversian system bone which is primarily laid down in cartilage.

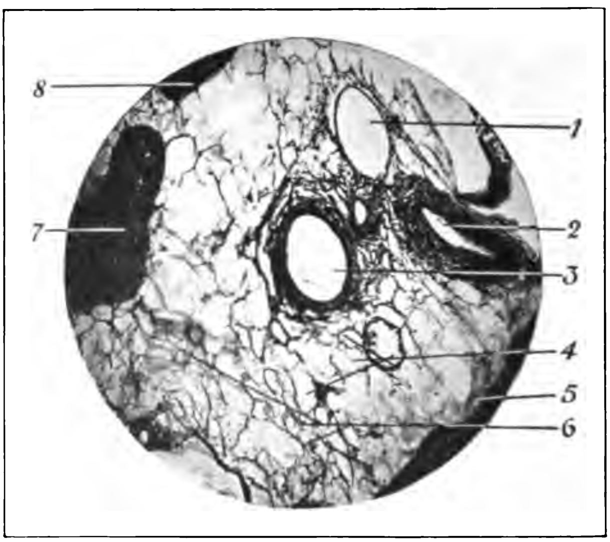

Fig. 6.—Human alveolus showing the medullary spaces and vascularization of same. Compare this illustration with Fig. 5.

tween the inner border of the lateral plates of the alveolus; 8 and 8′, the alveolar dental ligament 10′; 10, the alveolar dental ligament on the inner surface of the palatine root; 10′, the alveolar dental ligament on the outer surface of the buccal; 11 and 11′, the periosteum; 12, an island of alveolus on one border of

which the alveolar dental ligament is attached; 13, the inner border of the island. (It is along this border that one observes many osteoblasts); 14, the intermedullary spaces between the islands of alveolus; 15 and 15′, the lateral plates of the alveolus; 16 and 16′, the periosteal borders of the alveolus.

We have now shown the relation of the developing tooth to the developing alveolus schematically, and from the drawings learn that as the tooth develops there is a lateral expansion of the lateral plates of the alveolus and that the space thus created is filled in with alveolus at a future time. Let us now continue our study of the alveolus with some photomicrographs made from sections.

In Fig. 5 we have bone which is laid down in cartilage. 1 is a portion of an haversian canal; 2 are the canaliculæ; 3 shows the lacunæ; 4 is a complete

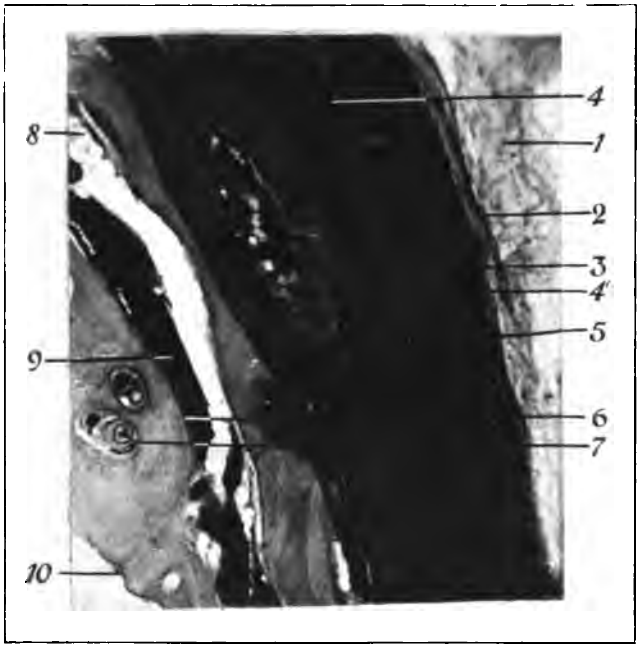

Fig. 7.—Showing the compactness of the lateral plate of the alveolus and the medullary spaces contained in it.

haversian canal; the canaliculæ communicate with the haversian canal and the lacunæ 6, while 7 are canaliculæ communicating with the lacunæ 6 and the lacunæ 8; 9 is the lining of the haversian canal. Studying this picture we at once note that the bone is very compact, and is laid down concentrically around the haversian canal.

The next photograph (Fig. 6) is from a medullary area in the substance of the completely developed human alveolus. Beginning at 1 we have the lymph vessel; 2 is an artery; 3, a vein; 4, fat cells; 5, alveolus; 6, areolar tissue; 7, the alveolus; 8, the alveolus. This picture shows conclusively that the alveolus is very vascular and that it is very loosely constructed when compared to Fig. 5.

Fig. 7 shows the lateral plate of the alveolus of the rhesus monkey. Beginning at 1 which is the periosteum and advancing to 2 which is the periosteal

border of the alveolus; 3 is the lateral plate of the alveolus proper, while 4 is a medullary space near the periosteal border; 5, the inner border of the alveolus (it is along this border that we observe the osteoblasts); 6, the border of the island of the alveolus which faces the border of the lateral plate of the

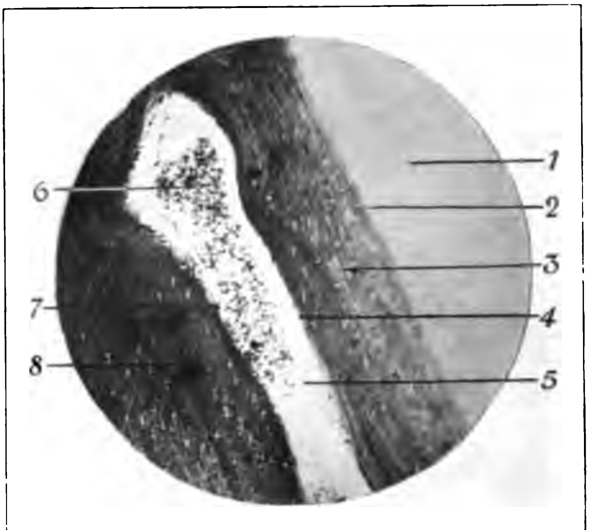

Fig. 8.—A medullary space in the alveolus which also shows the compactness of the lateral place and the density of the periosteum.

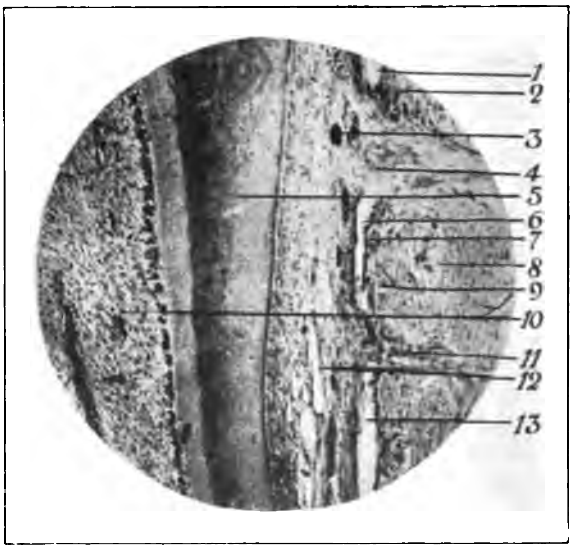

Fig. 9.—The relation between the developing root and the alveolus.

alveolus; 7, small medullary space which lies between the inner border of the lateral plate of the alveolus 3 and the border of the alveolar island 9; 9, the outer border of the alveolar island facing the capsule surrounding the developing tooth. Careful observation of this picture does not show any cells present on the periosteal border of the lateral plates of the alveolus.

Fig. 8 shows a medullary space in the substance of the lateral plate of the alveolus near the periosteal border. 1 is the periosteum (this picture was made very dense, hence no fibers are shown); 2, the periosteal border of the lateral plate of the alveolus; 3, the alveolus lying between 2 and the border of the medullary space; 4, the border of the medullary space; 5, the medullary space in the substance of the alveolus of the lateral plate; 6, fine granular debris and erythrocytes; 7, a border of the medullary spaces; 8, lacunæ of the alveolus.

Let us now study Fig. 9 which is a photograph of an area showing the developing root of the tooth and the developing alveolus. 1 is a medullary space between the alveolus and the alveolar dental ligaments; 2, a portion of an island of alveolus; 3, a cross section in the substance of the alveolus; 4, a bundle of the alveolar dental ligament passing between islands of the alveolus; 5, the developing root of the tooth; 6, a medullary space between the alveolus and the al-

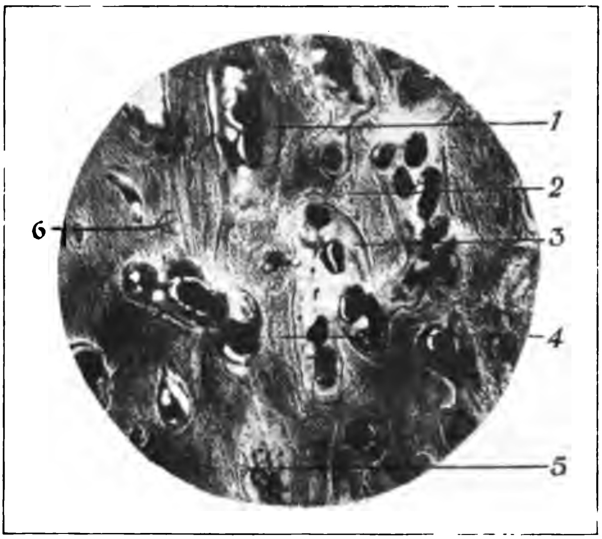

Fig. 10.—An area of the alveolus between the roots of a developing tooth.

veolar dental ligament; 7, a border of the alveolus along which one observes a few osteoblasts; 8, an island of the alveolus; 9, lacunæ of the alveolus; 10, the odontoblasts; 11, another bundle of the alveolar dental ligament passing between the islands of alveolus; 12, a longitudinal section of a blood vessel in the alveolar dental ligament; 13, medullary space between the alveolus and the alveolar dental ligament.

In Fig. 10 is shown the area midway between the developing roots of a permanent molar. 1 is a medullary space; 2, an area around a medullary space in which the process of development is almost completed; 3, an area in the substance of the alveolus which is developing; 4, the lacunæ commencing to arrange themselves; 5, osteoblasts; 6, an area of partial development of the alveolus. This area of alveolus shows us that at this time there are many foci of active developing bone centers.

In Fig. 11 is shown a field which lies directly between the bifurcation of

the roots of the developing tooth. At 1 is shown medullary spaces. The developing bone in the immediate vicinity of these medullary spaces has commenced development; 2 is an area of early development of the alveolus showing small clumps of osteoblasts; 3, an island of alveolus in which the lacunæ have

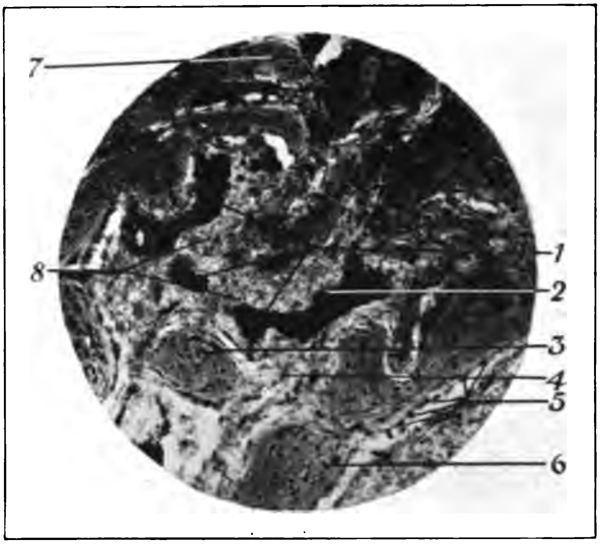

Fig. 11.—An area of developing alveolus.

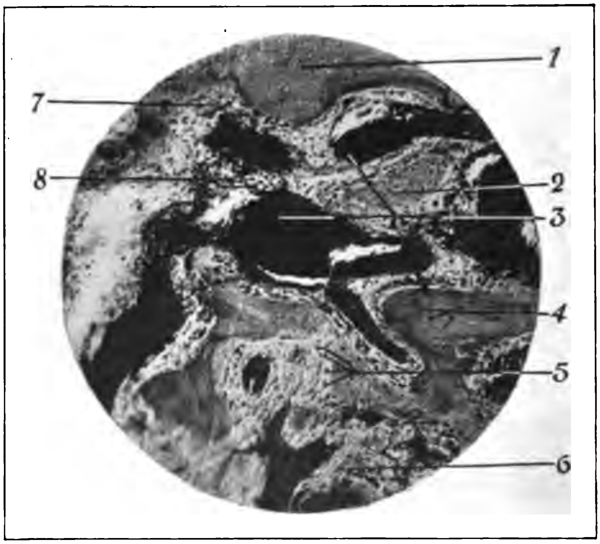

Fig. 12.—An area of developing alveolus in the vicinity of the palatine root.

commenced to arrange themselves (on the border of this island one notes osteoblasts); at 4 one observes a row of osteoblasts free in the medullary substance; 5 shows osteoblasts along the border of an island of the alveolus; 6, a partially completed island of alveolus; 7, an area which is composed of a few lacunæ

surrounded by osteoblasts; 8, the medullary substance which is rich in erythrocytes and osteoblasts.

Fig. 12 shows an area in the immediate vicinity of the palatine root. 1 is an island of alveolus along one border of which osteoblasts are observed; 2, an

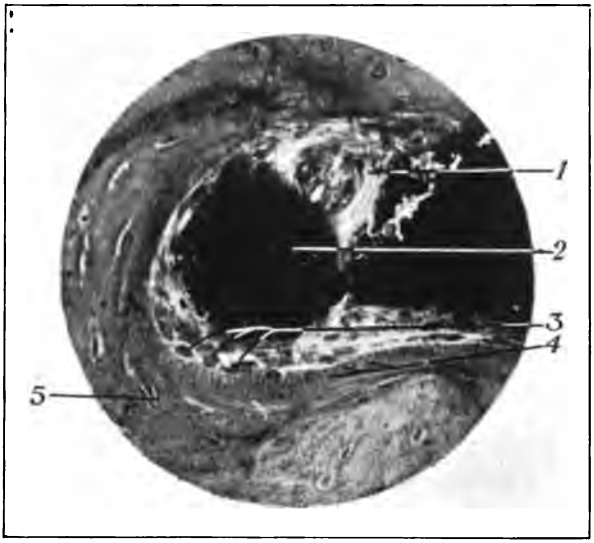

Fig. 13.—A high magnification of the medullary space in the alveolus.

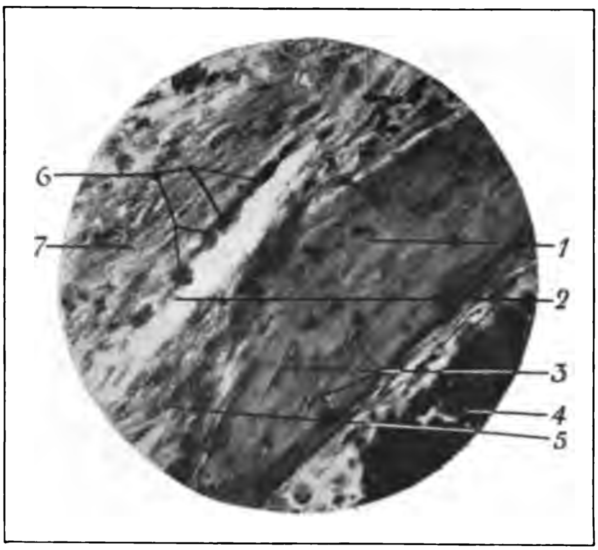

Fig. 14.—A high magnification showing many osteoblasts.

island of alveolus the borders of which show an active development of the alveolus; 3, a large medullary space; 4, the lacunæ of the alveolus (along the border of the island in which they are shown one notes many osteoblasts); 5 shows very distinctly osteoblasts present in a very loosely constructed mass of alveolus;

6 shows osteoblasts present in the medullary substance; 7, a few osteoblasts present in the medullary substance near the island of alveolus 1; 8, an early stage in the development of the alveolus above the medullary space 3.

Fig. 13 is a higher magnification than any of the photographs shown thus far. 1 shows a mass of fine granular debris, erythrocytes, and a few osteoblasts; 2, the medullary space proper; 3, osteoblasts along the border of the alveolus facing the medullary space; 4, canaliculæ which communicate with the lacunæ of the alveolus and the medullary canal; 5, lacunæ of the alveolus.

In Fig. 14 is shown an area in the substance of an island of alveolus. 1 shows the alveolus proper; 2, a medullary space extending upward into the substance of the alveolus; 3, lacunæ in the substance of the alveolus; 4, a large medullary space along the border of the alveolus (facing this space one notes a few osteoblasts); 5, osteoblasts along the border of the alveolus facing the medullary space 2; at 6 the osteoblasts stand out in bold contrast to the early developing alveolus; 7 shows the lacunæ faintly in the substance of the young alveolus.

From the foregoing evidence presented by schematic drawing and photomicrographs which were made from sections of the jaw of the rhesus monkeys we are no longer dealing with empiric teaching, but are using material at first hand which does not agree with former theories, namely, that the periosteum is necessary in the development and the regeneration of bone. On the other hand we believe that the periosteum is a limiting membrane for the development and regeneration of the alveolus. The findings thus offered confirm the findings of Macewen and Dobrovolskaia.

GROWTH

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THE solution of the chemical problems of growth has been approached along various avenues. One of these, and perhaps the earliest to be followed by any considerable number of investigators, leads to the *chemical analysis* of both growing and fully grown individuals. Its primary object is to disclose the characteristics of growth by a comparison of the chemical composition of organisms at various stages of their development. Despite the considerable abundance of data thus accumulated, relatively little of major importance has been contributed thereby to our knowledge of the subject. Growing cells and tissues may be morphologically and functionally unlike the fully developed structures into which they are finally transformed, but the analytical methods of the chemist of today are not sufficiently refined to reveal any eminently unique features of makeup characteristic of growth.

It is true that embryonic and other growing tissues are comparatively rich in water, and that the water-content diminishes to a certain degree with increas-

ing age; but aside from such rather inexpressive generalizations respecting quantitative variations in composition at different stages of growth, no striking facts have yet been furnished by the devices of tissue analysis. Equally unprogressive has been the study of the comparative biochemistry of growth in the direction of qualitative analysis. From a purely biological standpoint it is of interest, and a result perhaps to have been anticipated, that there is a fixity, so to speak, in the composition of animal structures at various sizes of the same individuals. The number of the cells or the volume of each of them may be increased enormously; yet, broadly considered, the available analytical data show no striking differences in the chemical organization of the resultant protoplasmic mass in comparable tissues at various periods. In other words, aside from transitory depositions of reserve materials such as glycogen or fat, muscle remains alike in its gross composition, and the nervous substance exhibits essentially the same chemical characteristic components, independent of age, diet, or environmental condition.

Several years ago a study of the composition of the bodies of mice kept upon diets of widely different types led one of us to express the outcome in these words: "The constant composition of the organism which is exhibited by our analysis, does not speak in favor of the possibility of depriving the body by alimentary procedures of any constituent excepting fat that is essential for its functions. On the contrary, it appears that the organism adheres to its proportionate composition. A deficiency in the diet, a lack of some food component, is not responded to by growth in which the tissue produced is chemically abnormal and shows a depletion in the missing factor. Its composition remains unaltered. Normal growth can proceed only when all the important constituents are assimilated in the proportions in which they make up the body. Losses are sustained only by the *uniform* disintegration of the tissues, whereby their relative composition remains unaltered."[1]

A more effective advance upon the chemical questions relating to growth has been made by the study of *nutrition* in this period of life. This more modern plan has meant a determination of what constructive units are essential for the building up of an adult organism, what materials must be furnished to the growing individuals, what possibilities of synthesis are inherent in them and will enable them to supply by construction the necessary tissue components. The successful pursuit of this method of inquiry depends upon the justifiable assumption, already mentioned, that protoplasm, if it is constructed at all, is not made into a fundamentally defective variety of diet, though deficiencies in the latter may lead to an unmaking of cells already developed.

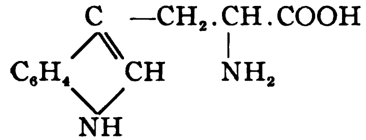
The questions relating to the initiation of growth and to the fundamental energy factors are not touched upon in this review. Certain modifying features of nutrition in growth are more or less obvious. The necessity for certain elements, like calcium, calls for no further comment here than to inquire to what extent the need of them is specific in growth. In the ordinary wear-and-tear of life, or what is technically designated as the maintenance metabolism, losses

[1]Mendel, L. B.: Der Einfluss der Nahrung auf die chemische Zusammensetzung des Tierkörpers. Biochemische Zeitschrift, 1908, xi, 281.

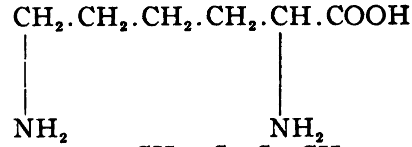
of structural elements call for restitution. In the case of the most of them we shall probably not err widely in saying that the metabolism of growth represents a highly exaggerated instance of the same needs but on a scale appropriate to produce increment instead of mere maintenance of body substance.

Modern chemical physiology has demonstrated in a convincing way that the diverse proteins which are now known to occur in nature can no longer be considered solely in a generic way in the roles which they play in the organism. These nitrogenous compounds lose their biological identity even before they leave the alimentary tract, by becoming disintegrated into the chemical units—the amino-acids—out of which the proteins are built up. In so far as these amino-acids merely serve as fuel, it seems to matter little what their precise nature is. All of them can be, and usually are, destroyed readily in the metabolism. Inasmuch as tissue proteins are broken down in a small, yet seemingly inevitable degree in the wear-and-tear, the problem of satisfactory restoration arises. During growth additional new protein molecules are to be provided. At the present time it may be said with confidence that many, though not all, of the amino-acids must be offered ready-made in the diet, because there is no evidence that they can be synthesized *dc novo* even in growing mammals. For the lower forms of animal life this statement may not be valid, as it is not in the case of plants. In the higher forms, however, the exhibition of dietary proteins which are deficient in respect to their yield of any of the essential amino-acids may be expected to lead to suppression of growth and even failure of maintenance, depending on the degree and nature of the structural shortcomings.

The evidence in support of this general statement has resulted from the possibility of preparing a ration which is complete or adequate for growth in every respect other than the protein component. This latter factor can then be added experimentally in any way desired. The casein of milk is one of a few proteins which fail to yield the amino-acid glycocoll $\begin{array}{l} CH_2.COOH \\ | \\ NH_2 \end{array}$ upon analysis. Tissue proteins, and particularly those of the omnipresent connective tissues, include a relatively large content of the glycocoll group in their make-up. Yet animals can be grown to maturity and into a second generation upon a diet containing the glycocoll-free casein as practically the sole source of food protein. Here, then, is a striking illustration of the capacity of a growing organism to supply, by synthesis, one of the essential amino-acid constructive units of its protoplasm. On the other hand, there are proteins, particularly of vegetable origin, which fail to furnish one or more of the amino-acids, such as tryptophane which tissue proteins also yield. As the result of very recent experimental investigation there is little room for doubt that all of these mentioned amino-acids must be furnished ready-made to an organism for the constructive uses of growth. The organic chemist will appreciate why the laboratory of the living cells may be unable to synthesize nuclei so complex as those of tryptophane or tyrosine and yet be competent to produce a comparatively simple product like glycocoll.



or lysine



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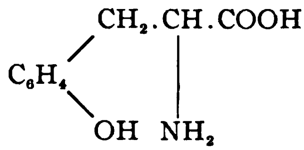
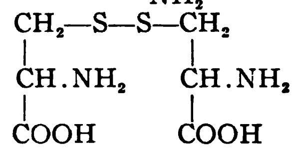


or cystine



The best proof of the indispensability of some of the amino-acids has been furnished by actual feeding experiments. Without the proper complement of these units, even the best diet spells disaster; and the addition of the missing ones, either as such or in the guise of proteins containing them, brings renewal of growth proportionate, as a rule, to the extent to which the deficiencies are made good quantitatively as well as qualitatively. The lack of an essential protein factor need not be an absolute one to produce malnutrition. It has become apparent, as Abderhalden pointed out long ago, that where the organism cannot synthesize an essential fragment, the nutritive pace is set, so to speak, by the minimum of any indispensable dietary ingredient. In practice this means that however abundant in protein and seemingly "balanced" a diet may be from the standpoint of the theories of nutrition of a generation ago, it is certain to be inadequate for growth if the proteins are qualitatively unsuitable as in fact they may be if derived from a single source.

For the problems of practical dietetics and particularly of animal production it is further of interest to note that chemically identical proteins are apparently not present in animals or plants of different species unless they are biologically closely related. In so far as the differences are an expression of inequalities in the amino-acid make-up of the protein from these varied sources they are likely to have significance in the construction of a dietary suitable for growth. There are various protein by-products, for example from the cereal, milk and meat industries, which are available as low priced nutrients and the successful use of which must henceforth be determined, in so far as they enter largely into the rations of growing animals, by the standard of their competence to furnish the essential amino-acids suitably. It has been shown that unquestionable differences exist in the economy of correcting various inadequate protein foods with appropriate supplementary proteins. The problem seems in part at least to be one of suitably combining products that are deficient in one or more nutrient units so that the mixture shall not have any serious relative shortage of any one of them.

The upshot of these newer developments in the physiology of nutrition has been to give a new trend to the biochemistry of the proteins and to lend a greater importance to this pre-eminent group of food stuffs. Those whose field of interest lies far away from these strictly chemical aspects of nutrition will appreciate the comment of one of our colleagues (von Fürth) when he says: "I invariably experience a feeling of envy when I read the letters of Liebig, Wöhler, or Berzelius, and note how important an event for these fortunate in-

dividuals was the appearance of every scientific publication. With what devotion and joy they read and re-read every detail of even the smallest scientific contribution. Today, owing to the great mass of scientific literature, we are in danger of losing the naive pleasure which anything novel should afford; and we are likely to sacrifice the spirit of inquiry or inquisitiveness that attaches to the soul of the man of science. And so, today when the devotee of biochemistry, working in the sweat of his brow, is barely able to orient himself in the essentials of its literature, familiarity with its content has long since become an impossibility for him who stands apart from any immediate concern with such topics." (v. Fürth: Probleme, i, p. 2.)

And now, at a time when the energy problems of growth have reached a degree of solution that gives a clear and fairly comprehensive insight into this aspect of nutrition, so that this chapter of physiology can at length be reviewed with a fairly satisfactory understanding of what it involved, entirely new questions have thrust themselves into the foreground. Physiologists have long realized that the ideal way to study the problems of nutrition would be by feeding artificial mixtures of the isolated and purified nutrients. The successive failures of the attempts in this direction, which need not be detailed here, coming in conjunction with evidence from other sources, have awakened us to the realization that perhaps something more than the familiar proteins, fats, carbohydrates and inorganic nutrients are essential to the persistence of the life processes or the accomplishment of prolonged growth. The modern researches on the physiological significance of the secretions of the ductless or so-called endocrine glands and the growing evidence for the regulatory function of hormones or chemical stimulants distributed by the circulation have made it easier to believe that substances which are neither significant as sources of energy nor sufficiently abundant to construct new portions of protoplasm may nevertheless exercise a dominant effect upon nutrition. To one who has been brought up in the study of exact stoichiometric relations in science there is something almost unscientific and mystical in the discovery that mixtures of food stuffs which are selected from the chemist's supplies and fail to maintain animals can be made adequate by the addition of milk, for example, in quantities far too small to have significance as a source of energy. We are dealing here with what have been called food accessories or "vitamines."

Growth appears to be in some degree dependent upon the presence of chemical determinants of this order. For the present they must not be confused with other known essential nutrients, with suitable amino-acids, or inorganic salts, or appropriate carbohydrates. It must be recognized, at the outset, that unless the conditions are suitable for maintenance, growth which is normally superimposed upon it, cannot proceed. The value of food accessories of as yet unknown chemical nature has been made evident of late by feeding experiments with isolated food substances, where additions of small amounts of naturally occurring products have prevented nutritive decline or brought restoration. This is notably true of the "protein-free milk" devised by Osborne and Mendel for feeding rats. No artificial imitation of this natural mixture, which contains milk sugar, inorganic salts and very small quantities of unknown ingredients,

has been devised to replace it satisfactorily for considerable periods of growth. The success of the "natural" product seems to be dependent upon the presence of undiscovered "determinants" in minute traces. Evidence for the existence of such accessories is further furnished by the so-called deficiency diseases. In some cases heating seems sufficient to destroy some thermolabile determinant of maintenance. The development of scurvy from the use of heated foods is an illustration of this point.

It is not unlikely, in the light of the meager data now at hand, that there is more than one determinant or food accessory that promotes suitable maintenance. There is no justification whatever for including these unknown factors today in a common chemical group aside from the fact that they seem to be essential and to act in small amounts in ways not hitherto taken cognizance of. Some of them are unquestionably quite thermostabile, others are perhaps thermolabile. With the possible exception of Funk's beriberi "vitamine" they have hitherto eluded chemical identification. Perhaps they merely stimulate the appetite and thus induce an adequate food intake; though this explanation seems to be clearly contradicted by some of the existent reports. Perhaps they merely supply cell adjuvants like iodine or manganese or some organic compound, the need of which we have overlooked because it is quantitatively so small. In any event they represent an undetermined factor that must be reckoned with.

However, an adolescent animal may actually fail to grow upon a diet which serves well to maintain an adult individual of the same species. Grown rats have been kept in good health for many months on a ration consisting of protein, sugar, starch, "protein-free milk" and lard. Upon this diet the young of the same species grow for a limited period and then invariably decline. We have had the almost paradoxical experience that those animals which grow on the diet mentioned presently die, whereas those which do not experience growth are more likely to continue to live. This may be interpreted to indicate that in growth an essential substance presumably stored in some measure in the adolescent organism is used up, whereupon nutritive failure ensues; whereas in the absence of active growth a depletion of the material so necessary does not take place in the same degree. It has been shown that this cessation of growth can be stopped and growth resumed by the substitution of other naturally occurring fats for part of the lard of the ration. In butter-fat, egg-fat, cod liver-fat, and beef-fat,—and more specifically in the fractions of these containing the oil components liquid at ordinary temperatures—there exists a determination of growth in the sense in which this expression has been discussed above. It is apparently not a nitrogenous or phosphorized compound like the phosphatides which have been charged with growth-promoting effects, but experimentally its action is pronounced in rats. When other factors, such as suitable proteins or salts, are missing the chemical accessories yielded by the natural fats are obviously incapable by themselves of insuring growth.

How or why do these chemical determinants promote growth? The best that we can do today is to recite the facts. Perhaps they promote appetite and lead to gain of weight by inducing suitable food intake. It is not easy to reconcile such a hasty explanation with the marked differences between the fats

studied. Perhaps they merely represent chemical ingredients necessary at all times for the body cells, but needed in great abundance during increment in size and therefore not available in sufficient amounts in a diet adequate for mere maintenance with limited wear-and-tear or tissue loss. These problems are still with us.

New Law Provides "Dental Hygienists"

THE Governor of New York has just signed a bill which provides for the training, registration and licensing of dental hygienists. This marks the enactment into law of recommendations made some time ago to the Department of Health by one of its advisory committees. The committee's action was due to the great need for increased attention to the condition of the teeth of school children in New York, of whom, it is asserted, at least 90 per cent require dental treatment.

A subcommittee, appointed to investigate the matter, recommended the desirability of using dental hygienists and urged that a trial of the surface cleaning of children's teeth be made as soon as possible in one or more centers, preferably public schools, and that at the same time the children be given instruction in oral hygiene.

The new law provides that any dental dispensary or infirmary, legally incorporated and maintaining a proper standard and equipment, may establish for women students a course of study in oral hygiene. Such students shall present evidence of one year's attendance at high school, and after one year may be graduated as dental hygienists, upon complying with the preliminary requirements to examination. After satisfactorily passing the examination these students shall be registered as dental hygienists by the regents, under such rules as the regents may prescribe. Any licensed dentist, public institution, or school authorities may employ such dental hygienists, who may remove lime deposits, accretions, and stains from the exposed surface of the teeth, but shall not perform any other operation on the teeth or tissues of the mouth. The law follows the enactment of similar ones in Massachusetts and Connecticut, and it is expected that with the preventive steps made possible by the employment of such workers the condition of the teeth of the coming generation may be greatly improved.—*Health Bulletin,* New York City.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID McCOY, D.D.S., EDITOR
LOS ANGELES, CALIF.

THE RADIOGRAM AS A FACTOR IN BETTER DENTAL SURGERY

BY EDGAR HAYDEN KEYS, D.D.S., ST. LOUIS, MO.

RADIOGRAPHY as applied to dentistry as a means of diagnosis and prognosis is assuming the role of a Nemesis, mercilessly exposing errors of commission and omission in all directions.

A most significant fact established by radiography is this—men who "admit" that they are superior operators, men who we "admit" are superior operators, the so-called mediocre part of the profession, and the charlatan, all are indicted by the radiograph.

Quite true, the skillful conscientious operator is remiss relatively to a lesser degree than his less skillful colleague, but even his percentage of failures emphasizes the imperative need of greater care, and something additional to our armamentarium, and that something is the x-ray.

In the past we have depended alone upon tactility in our root canal operations, and for this reason, we have condoned our many errors. Now that the radiograph affords us visual aid, can we excuse similar failures?

At an expense of much valuable time and energy we have been changing cotton dressings with a frequency that exhausted the patience of both operator and patient, whereas if a radiograph had been obtained at the initial visit, an extraction and alveolotomy or apicoectomy would probably have been clearly indicated.

It is now an accepted fact that our root and root canal surgery can only be correctly performed and checked by studying the findings of the radiograph.

Dr. Haskin, of New York, in the *Dental Cosmos,* October, 1916, says: "The radiograph has brought about the greatest advance in the practice of dentistry, and the time has arrived when no dental practitioner should be allowed to practice unless his office is well equipped for this work." With the first part of the Doctor's statement I think we cannot disagree; the latter part, however, is irrational, since we can enlist the services of the man who specializes in radiography, just as surgeons, the majority of whom do not make their own radiographs, enlist similar services.

So much attention is now being attracted to the possible connection between oral septic disturbances and infective processes in other parts of the body (metastatic infections), that it is not at all rare for a physician to refer patients to a radiographer, and in some instances, depend upon his own inter-

pretation of the radiogram and advice as to dental procedure. But it can be said in justice to medical men that quite a number always consult with and seek the co-operation of the dentist.

The question of how the patient is to secure the services of the radiographer is a serious one in many instances. It is a fact that every dentist has among his patients a certain number who are able to afford dental services only where a minimum fee is charged. The extra charge of a radiographer in such cases would entail an expense which they could not meet. However, in every large city there are hospitals that have departments of radiography where arrangements can be made for services at a minimum charge to people of small means. While it is easy to comprehend why a patient of decidedly limited income cannot afford the additional expense of a radiographer, it must be admitted here that it has been no easy matter to convince many people of ample means of the necessity of the co-operation of a radiographer, and until the public is more fully informed upon the importance of radiography in dental operations, this opposition will be encountered. Arrangements can be made between a dentist and some radiographer where a blanket fee will pay for about three serial films of a root canal operation. Three films will suffice for the average case.

The installation of equipment in your own office has disadvantages which are possibly outweighed by its advantages. The busy operator has little time that can be spared for radiography, and it would seem to the writer to be impractical to do this work unless it could be done by a trained assistant, the operator doing nothing more than placing the film. An additional fee of five to ten dollars included in the bill for dental services will cause no complaint upon the part of many people who object to going to radiographers on account of extra expense.

The writer would like to call the attention of the men who are contemplating the installation of machines to an excellent article from the pen of Geo. M. MacKee, M.D., New York, which appeared in the *Dental Cosmos,* April 1916. He emphasizes "the necessity of the dentist to acquire a requisite knowledge and experience before doing this work." Frequent cases of radiodermatitis have been observed by Dr. MacKee resulting from x-ray examinations of the teeth. The concluding paragraph impresses the reader that the whole article has been written for entirely unselfish reasons.

A few cases herein presented demonstrate to the writer's mind the radiogram to be an indispensable adjunct to most dental operations.

Case 1.—Case had been under treatment for months prior to coming to the writer's office. Diagnosis had been dento-alveolar abscess, the central incisor evidently being considered the sole cause, since the operator handling the case had confined his efforts to sealing the central incisor with some medicament, same being removed soon afterward on account of causing intense pain.

At initial visit a radiogram was obtained which tells the tale. It is clearly shown in the film (Fig. 1) that the apices of both the central and lateral incisors were involved in the same area of suppurative ostitis, the lateral incisor being the cause or point of infection, and the central incisor being the drain which

when treated and sealed would cause intense pain, necessitating the reopening of the tooth. This had been the procedure for about four months.

Treatment as indicated by the radiogram was the opening of the lateral incisor, the cleansing and disinfecting of the canal, insertion of a root canal filling; the same procedure was followed with the central incisor, after which apicoectomy of both teeth and curettement of the area were resorted to. The patient experienced no further trouble and a satisfactory result was obtained as is shown in the radiogram (Fig. 2) taken one year later.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Case 2.—This case demonstrates a common error of both omission and commission: an error on the part of the writer in not having had the root radiographed at the initial visit, which had been filled some two or three years previous by a competent operator, an error upon his part which is clearly shown in the radiogram (Fig. 3). One year after porcelain crown of the writer's construction had been placed upon the root, trouble could be detected by palpation over apex. With the aid of a radiogram, apicoectomy and curettement were resorted to. A good result followed and the destruction of the crown was thus obviated. Fig. 4 shows condition of area two months after operation.

Case 3.—Case presented for construction of a new bridge to take the place of one seen on the radiogram. Upon examination, the mucosa over the edentulous area was found to be in a condition that would not indicate the presence of root fragments in the alveolus. Inquiry into circumstances as to how the

teeth were lost, and the answer that patient had fallen down the steps and the teeth were fractured, prompted the securing of a radiogram. Radiogram (Fig. 5) clearly shows presence of apical third of both the central roots which were removed prior to construction of the new bridge, thus obviating a possible cause of subsequent disturbances.

Case 4.—This case demonstrates the value of the radiogram as an aid in prognosis (Fig. 6), convincing both to operator and patient.

Case 5.—Patient suffering intense pain along side of face, and in frontal

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

region. By elimination cuspid was suspected, and radiogram obtained. Focus of infection is clearly shown at apex and running slightly toward crown on mesial side. Apicoectomy and curettement were resorted to. Cessation of pain followed shortly after operation. Fig. 8 shows radiogram of the same case one month after operation.

Case 6.—Patient had no feeling in mucosa from lower bicuspid forward, or in lip to median line, indicating an involvement of the inferior dental nerve or its mental branch. Radiogram (Fig. 9) shows suppurative ostitis at apex of first bicuspid. Extraction of tooth was advised, a recovery of parts to their normal condition soon followed.

Case 7.—Patient experienced trouble about the apex of the first bicuspid, held in position by dental splint which had been applied to retain cuspid, bicuspid, and first molar. The radiogram (Fig. 10) shows a fracture near the

apex of the first bicuspid. This fragment was removed and the end of the remaining root smoothed. A satisfactory result was obtained.

Case 8.—This radiogram (Fig. 11) shows an ineffectual attempt to resect the apex of the mesial root of the lower first molar.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

Case 9.—This is a demonstration of the usefulness of the radiogram in determining the size of roots of malformed teeth. The so-called peg-shaped tooth sometimes has a normally developed root and can be used for a dowell

and diaphragm crown restoration. The radiogram (Fig. 12) demands the application of a jacket crown.

Case 10.—Patient experienced full pain on side of face, no localized area, percussion or palpation revealed nothing. The faradic battery, to a certain extent, placed suspicion upon the left central incisor; this was confirmed by the radiogram (Fig. 13). Central was opened and treated, bringing about complete relief.

Case 11.—This is an instance where work of former operator was checked before completing a restoration of the upper cuspid by the writer. The film (Fig. 14) clearly indicates the need of a more perfect root canal filling.

Case 12.—Patient had all symptoms of streptococcus infection. All the teeth were radiographed, and molar with crown, as shown in Fig. 15, extracted. All symptoms disappeared within twenty-four hours.

The fact that none of the cases herein presented is unusual, but on the contrary, quite common in type, only emphasizes the importance of radiography in dental surgery.

Rœntgenographic Diagnosis of Dental Infection in Systemic Diseases

COMING from one of such eminence as Dr. Tousey, this little volume* is destined to stimulate considerable interest in the important subject which the title describes.

Recent developments in pathology render the clinical reports and observations made by its author more convincing than they could possibly have been a year or two ago, even though the clinical and radiographic evidence, backed up by Dr. Tousey's long experience, were sufficient to remove all doubts from his own mind as to his conclusions.

The opening paragraph of the author's introduction contains a paragraph worthy of emphasis, not only to a large number of physicians and dentists, but of great educational value to the public. It reads in part as follows:

"The widest publicity should be given to the fact that greatly varying and sometimes serious or fatal systemic diseases, and those affecting remote organs, are often due to infection connected with the teeth, or with the pneumatic sinuses."

In speaking of alveolar abscesses as sources of infection, the important fact is emphasized that these lesions sometimes develop insidiously and without local symptoms, which renders them more dangerous because they are not recognized, and therefore are not treated.

Therefore physicians having cases of systemic infection under observation and treatment in eliminating the teeth as a factor should not be satisfied with a dental examination which does not include a radiographic survey of the teeth and the enveloping structures.

The author's description of an alveolar abscess from an anatomical and pathological standpoint will no doubt seem exceedingly elementary to dentists.

*"Rœntgenographic Diagnosis of Dental Infection in Systemic Diseases," by Sinclair Tousey, A.M., M.D., New York City, Published by Paul B. Hoeber, New York City. Price, $1.50.

but no doubt it will be of value to many physicians who have heretofore never felt called upon to interest themselves in the anatomy and pathology of the teeth and correlated structures.

In discussing pyorrhea alveolaris as a source of systemic infection, and methods of procedure for its alleviation, the author states that all causes for this affliction "revealed by the x-ray" should be removed, such as "hard calculous scales from the root of the tooth," and "suitable chemical applications made to the pocket." This treatment by the dentist he considers indispensable, but suggests that in many cases such treatment should be supplemented by x-ray therapy and high frequency currents from ultra violet ray vacuum electrodes.

The warning is then given that "it certainly requires a great deal of experience and study in this particular field to make applications which shall be effective through the flesh and bone, and still have no undesirable effect upon the skin."

In emphasizing the important bearing of the teeth in systemic infections, Dr. Tousey states that in the important recent investigations of Hartzell, Henrici and Leonard, "in the medical wards they have studied especially arthritis, acute and chronic ulcer of the stomach, heart lesions, pernicious anemia, nephritis and nervous diseases of the neuralgic type. They find no important distinction between dental abscesses and pyorrhea as causative factors in these diseases. Either is frequently the sole cause and even in cases originating from tonsillar or other large foci of infection, the presence of pyorrhea or dental abscesses will keep up the disease after the large focus has been cured. All these cases are markedly improved by complete extirpation of the foci of infection."

The text of this recent contribution is profusely illustrated with seventy radiographs depicting the majority of the pathological and anomalous conditions of importance which are revealed by x-ray examination of the teeth and adjacent structures and which have a bearing upon systemic infection. The text is brief (72 pages) almost too brief in fact, but can be read with profit by anyone interested in the subject.

Among the author's conclusions, the last paragraph seems particularly worthy of repetition. "The x-ray is to be depended upon to show whether or not the source of trouble is connected with the teeth or the pneumatic sinuses, and if so, whether the trouble is due to malposition and unnatural pressure, or to infection. It would be a mistake to regard every case as due to the teeth, and proceed to sacrifice the latter without first making a radiograph which may acquit them of any complicity in the matter.

The Rœntgen Ray in Dental Practice

DR. A. H. MERRITT (*American Journal of Roentgenology*, 1916, iii, 264) discusses the use of the rœntgen ray in the following conditions: (1) periapical infections, (2) pyorrhea alveolaris, (3) missing and impacted teeth, (4) facial neuralgia.

1. Periapical infection. When a tooth loses its vitality it is only a question of time when it becomes infected. The acuteness or chronicity of the symptoms of this infection depend upon the number and virulence of the organisms engaged. If the infection lapses into the chronic state, the pain subsides and the patient is usually unconscious of its presence. A discharging sinus may be present or a blind abscess may surround the root of the tooth. Differentiation between these two conditions cannot be made by the rœntgen ray, nor is the severity of the infection disclosed by rœntgen examination. Every non-vital tooth should have the pulp removed, the root-canal sterilized and filled to the end in order to prevent trouble which is certain to come unless this is done. If abscess is already present in addition to this, the abscess should be opened through the alveolar process, curetted, packed with sterile gauze, and allowed to heal from the bottom. If the end of a root extends into the cavity, it should be amputated. Teeth treated in this manner are not a menace to health and should not be indiscriminately extracted. Where extraction is necessary it is advisable to first procure cultures for autogenous vaccines, as the secondary constitutional symptoms do not always clear up with the removal of the exciting cause.

2. Pyorrhea alveolaris. The amount of destruction of bone in this condition is not always correctly shown by rœntgen examination. If the necrosis occurs on the labial or lingual surfaces of the tooth, it will not be visible on the rœntgenogram. If it occurs on the lateral surfaces only the condition may appear to be worse than it really is.

3. In missing or impacted teeth the rœntgen ray is indispensable, not only to demonstrate the presence or absence, but also the relative position, of the teeth in question.

4. Facial neuralgia. If this trouble is caused by pulp nodules, or by enlargement of teeth roots (hypercementosis) the rœntgen ray is of great diagnostic value. The author lays great stress on the fact that it is seldom necessary to ray the entire mouth if proper inspection is made previously. Pyorrhea is easily identified while periapical infections always occur in non-vital teeth. The only thing then left to ray are malposed teeth, which are usually molars.

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EDITORIALS

The Journal of the National Dental Association

SEVERAL years ago certain men of influence in the National Dental Association conceived the idea that the dental profession should have an independent journal. These men had many obstacles to overcome and objections were raised on every hand. Strange to say much opposition was encountered from men in the dental profession, and others who had interests in commercial houses did not desire the dental profession to have an independent dental journal.

The *Journal of the National Dental Association* has been published for a number of months and makes its appearance at intervals too far apart with the result that it has been found impossible to publish the majority of papers read before the National Association.

Difficulties have also been encountered due to the lack of funds, owing to the fact that the members of the National Dental Association have not sup-

ported the journal as they should. It was the desire of the promoters of the *Journal of the National Dental Association* to eventually have a journal which would bear the same relation to the dental profession that the *Journal of the American Medical Association* does to the medical profession. Before they can succeed, however, the dental profession must realize that members of the American Medical Association are paying dues of $5.00 a year for the support of their Association. Members of the dental profession must also remember that in order for this plan to succeed, they must contribute more to the support of their journal than they are now doing. However, at the present time, the large circulation and amount of advertising in the *Journal of the American Medical Association* makes this journal more than self-supporting. The question might be raised then—"Why would not the *Journal of the National Dental Association* be self-supporting?" The reason is that the dental literature for years has been dominated by commercial houses, and commercial houses have all the advertising mediums that they want. As long as the dental profession will support trade journals whereby the manufacturing concerns are able to get their advertisements before the profession through their own journals, and can do so at a much cheaper rate than they can by advertising in the *Journal of the National Dental Association,* trade houses will not support the *Journal of the National Dental Association.* As soon as the dental profession refuses to pay the advertising bills of the dental supply houses, as soon as the dental profession refuses to support the trade journals, just that soon will it be possible for the National Dental Association to have a journal and be able to sell advertising space at a financial advantage, and thereby make the journal self-supporting. Concerns that have their own advertising organs in which they can advertise free, and for which the dentists will pay $1.00 a year for the privilege of having the advertising matter sent to them, are certainly not going to support a national dental journal, which, by the way, has nothing to give except publicity, and which gives that publicity at so much per page. The only solution for the *Journal of the National Dental Association* is for the dental profession to get behind it and come to the realization that for a number of years they have been throttled and held down by trade journals, and just as soon as they do, and no sooner, will it be possible for the dental profession to assume a plane equal to that held by the medical profession.

The dental profession has long been asking for recognition from the medical profession, and nothing has mitigated so much against securing that recognition as the type of dental literature which has represented the profession for years. This was forced to the attention of the dental profession by a statement made by Dr. Hartzell from the platform at the last National Dental Association meeting while he was presenting the result of researches which he has been conducting under the direction of the National Dental Research Commission. He stated that the report in full would be published in the *Journal of Infectious Diseases* before it would appear in the *Journal of the National Dental Association* due to the fact that the scientific medical journals would not publish anything that appeared in the dental journals. This is very unfortunate indeed.

as it tends to show the respect or lack of respect which high class medical journals have for the dental literature and dental journals. The medical journals will recognize a few dental men, but will not recognize the dental literature as a whole, and the principal reason is because the dental profession has practically no journals of its own. The few that do exist have never received from the dental profession the support or recognition they merit, as can be proved by the lack of support which the *Journal of the Allied Dental Societies, The Nebraska State Dental Journal,* and the *Michigan State Dental Journal* have received, to say nothing of the *Journal of the National Dental Association.*

It is indeed very unfortunate that such reports as were given by Dr. Hartzell at Louisville must be published in a medical journal in order to secure recognition from the medical profession. Does this appear as though the dental journals of the past have served dentistry as they should? Does the lack of recognition which the medical journals give the dental journals prove the need of an independent scientific dental journal, not dominated and published by the dental supply house?

It is also very unfair to the dental profession to have research work which is supported by the National Research Commission, and incidentally by the dental profession, published in a medical journal before it is published in the official organ of the National Dental Association. It is a fact that at the present time the *Journal of the National Dental Association* is far behind with the publication of its articles, all because the dental profession has not supported the journal in a way to make possible the publication of the journal every month, or better, every week.

We think research work which the profession supports through the Research Commission should first be published in the *Journal of the National Dental Association,* and thereby make the medical journals recognize the fact that we have something in dentistry that is worth noticing. We do not believe that it is fair to everyone concerned to have the reports of the workers of the Research Commission published in medical journals because dentistry has no literature worthy of recognition by the medical journals. The answer to this problem is not the publication of the best that dentistry produces in medical journals, but the support of a dental journal which has the dignity to demand the respect of the medical profession. The *Journal of the National Dental Association* should be such a journal.

Preventive Orthodontia

IN some instances early treatment of malocclusion might be classified under another term, namely, preventive treatment. While there are other forms of prevention known and practiced among orthodontists, we do not believe they have ever been given the attention they deserve.

Prevention is the modern slogan of both the sciences of medicine and dentistry; it is the idea that is attracting the utmost amount of attention in science. The most heroic strides in the whole history of medicine have come about as a

result of the tremendous efforts in the prevention of disease. The members of the medical profession are doing yeoman service in preventive medicine, they are preventing the breeding of the mentally unfit, they have made typhoid fever preventive, and the limiting of cancer and the effecting of a cure is no remote possibility of the future. Dentistry has advanced hand in hand with medicine in her progress in the prevention of disease. We point to the oral hygiene propaganda which has called the attention of the world to the importance of oral conditions in relation to the general health, the preserving of the teeth and oral tissues by preventive prophylactic measures, and so on *ad infinitum,* but at the same time there has not been enough said about preventive malocclusion, and we feel that here is one place that merits attention in the orthodontic field.

We are aware that there are many cases of malocclusion which can be prevented from developing if they are recognized by some one interested in the child in their incipient stage, especially that type of irregularity resulting from vicious habits of the tongue and lip; then, too, those caused by hypertrophied lymphoid tissue and mouth-breathing or the too early extraction of deciduous teeth. In fact there are many malocclusions presented which have been developing over a period of years which can be prevented or at least remedied materially by the correction of habits at an earlier period and by advice as a result of intelligent diagnosis.

Dentists and medical men should be informed collectively and individually as to the etiology of malocclusions as we now know it, they should know the mechanism of occlusion and the tremendous influence exerted over the development of the bones of the face by the forces of occlusion and also the consequent results of perverted forces of occlusion.

The orthodontist who has a much better conception of the possibilities of the prevention of malocclusion unfortunately does not see his patients until the case is ready for corrective measures rather than preventive. The dentist and the medical man—also the pediatrician—are those who see these cases first; they see them at various periods during the development of the teeth and jaws, and consequently should be in a position to at least recognize the development of malocclusion in its very earliest stages if they are to render the best service to their patients and to society.

Like the history of all other preventive measures, the orthodontist can only hope to succeed through educational work, in his endeavor to extend the importance of this work; he should take great pains to teach the parents who come into his sphere, the importance of the early recognition of these conditions and the comparative ease of correction or prevention as compared to the advanced stage of malocclusion; he should point out to his confreres in the dental and medical professions, at each opportunity, that these conditions may sometimes be entirely avoided by proper recognition, and that at other times very simple and short corrective measures employed at the proper time may entirely thwart long tedious corrective procedure which would be necessary to follow a few years later.

The pediatrician above all others should know something of the subject of orthodontia particularly the progressive development of malocclusion, but un-

fortunately, at the present time, these practitioners have given little or no attention to the subject of malocclusion. While prevention of intestinal putrefaction and rickets have received no small amount of consideration, at the same time we believe a poor inefficient masticating apparatus incident to malocclused teeth to be one of the most effective causes of faulty metabolism.

The duty that confronts the orthodontist in this endeavor is a serious, but by no means an impossible one to discharge. Realizing that success in all human endeavors rests upon imagination, judgment and untiring energy, the orthodontist can undertake the work of prevention of malocclusion with a clear conception and almost positive assurance of getting results. Of the work to be done, there are three avenues open for propaganda work—the dentist, the pediatrician, and the orthodontist. Of these three the dentist is the one through whom the greatest good can be accomplished. Society has created a condition that is bound to keep recruiting the ranks of children with malocclusions—the bottle-fed baby, as an example. The dentist has an opportunity many times to do missionary work in preventing malocclusion before the child is born. Let him not hesitate to warn the expectant mother against the disastrous effects that sometimes occur as a result of raising the baby by artificial means. He should point out the effects of distal occlusions which may be started from this common practice.

The dentist in many instances is in a favorable position to be on the alert for the effects of an adenoid at the period when the child emerges from its infancy. He is in a position to point out the results, not only from an orthodontic standpoint but from every physical viewpoint, which may be expected if this condition is allowed to continue without attention. The dentist has known only one cause of malocclusion for so many years, namely, "adenoids," that it is *apropo* some other etiological factors should be privileged to also share this distinction. It has been so convenient and popular to say adenoids are responsible for so many disorders in children that suffice it to say that we should popularize at least one other etiological factor as the cause of malocclusion.

It is not uncommon to see the general health of an infant looked after while it is still *in utero*. Physicians know full well that the mother's surroundings, that her general nutrition, and her psychological condition during the period of pregnancy affects the health and well being of the new born. Why not put the infant after birth under the observation of the dentist, and why not arouse the dentist to the necessity of preventing malocclusion by proper care being given to the correct occlusion and relation of the teeth?

The pediatrician can play an important part in preventing malocclusion if the proper cooperation can be brought about between him and the orthodontist. He is now fully cognizant of the results upon developing arches of the constant use of the pacifier, and the constant tugging by an infant upon the nipple of a bottle, but he is not aware of the permanent deformities developing later in life which many times have such a simple start. A little missionary work on the part of the orthodontist among pediatricians and also among general practitioners of medicine, would in a short time greatly advance the cause of orthodontia as a profession.

Too many practitioners of medicine today associate the orthodontist with

the specialist in cosmetics because the orthodontist and his science have been so successfully featured from an idealistic standpoint. Many physicians believe that the correction of malocclusion is undertaken solely on account of a desire on the part of the parents of patients to bring about beautiful and symetrically arranged teeth. This is due primarily to the gulf that has existed so long between the medical man and the dentist and secondarily to the indifference of the orthodontist to widely extend orthodontic information among the practitioners of pediatrics and general medicine.

The orthodontist should keep constantly in mind that he who serves himself best serves others most. His efforts should be directed at all times to the education of parents who come under his influence as to how they can prevent teeth and oral deformities in their children. He should keep in mind that the dentist, the pediatrician, and the general practitioner should be constantly warned of the baneful effects upon childhood efficiency of malocclusions and at the same time that it is his duty to teach them subjects of this kind. He should be willing to devote a part of his time to this work and do it cheerfully. The physician should be made to realize that the early loss of deciduous teeth is a cause of malocclusion that can to a great extent be removed by proper prophylactic means. The laity have little or no conception of the value to the child of the first dentition. Little care is bestowed upon them because the parents have been taught for generations that, like the snake shedding his skin, the child would in time lose its deciduous teeth and these would be succeeded by permanent teeth. As a result of this, many children are made victims of a vicious malocclusion that could have been prevented had the proper care been given the deciduous teeth and their early loss prevented. No better work can the orthodontist do than to devote part of his day to educational work particularly in regard to the retaining of the deciduous teeth until nature has sounded their death knell. At least parents should be admonished of the possibilities of preventive malocclusion and their children periodically examined during the eruption of their teeth by a dentist who knows the landmarks of normal dentition and also the abnormal conditions.

In conclusion, the orthodontist should strive to prevent malocclusions in the very young by giving parents who come under his influence proper instructions with reference to those factors that are sure to produce deformities in growing children. He should endeavor by all means in his power to arouse among his confreres in the dental profession greater interest in preventive orthodontia, that they may advise the parents against influence and habits in the very young that will surely bring about malocclusion. He should extend his influence to the pediatrician and general practitioner and make them familiar with the results and possibilities of preventive orthodontia.

It should be more generally known that early correction of malocclusion is also preventive treatment; that in order to prevent malocclusion, treatment should be started as early as possible; that treatment should be complete by the time the permanent teeth are erupted with the exception of the third molar. Too much emphasis cannot be placed upon the importance of early observation of the mouth and teeth. One of the chief duties of dentists and orthodontists is to teach the gospel of prevention as well as that of a cure.

"The Rœntgenologist: Mechanic or Consultant."

IN the September issue of the American Journal of Rœntgenology, there appeared a very timely article under the authorship of Albert Soiland, M.D., of Los Angeles, in which the author called attention to the lamentable fact that rœntgenology is too often regarded by the medical practitioner in the light of a purely mechanical process, and as such is often referred to x-ray mechanics operating so-called x-ray laboratories.

In speaking of the situation, Dr. Soiland says:

"The extraordinary rapid strides of our science in all its phases have created many new conditions, some of which may well tax our capabilities to the utmost to properly meet and overcome.

"If our field of endeavor could be limited strictly to medical men, the elimination of many objectionable features would be easily accomplished, but the necessarily spectacular aspect of rœntgenology as a whole, and its appeal to laymen with more or less incomplete knowledge of electro-physics has enticed many to commercialize this science on a large scale.

"This has given birth to veritable x-ray picture galleries where x-ray plates are made of everything possible and impossible and at rates that range from a dollar up, and now our country is fairly overrun with men, neither medically nor scientifically qualified to compete with the trained medical rœntgenologist, yet supported by members of our own profession because they will grind out pictures at cut rates or at so much per dozen.

"Assuming that this statement is correct, there are three main reasons for this deplorable state of affairs. Either the clinician considers himself competent to interpret plates and applies to the lowest mechanical bidder to make same, or he places the *commercial radiographer* upon the same level with the *medical rœntgenologist,* or he has not yet fully realized the importance of medical rœntgenology nor associated with it the inseparable essentials of a well-balanced knowledge in all the subjects that go into the making of an efficient medical consultant.

"In our own city I personally know several colleagues who would rather patronize a lay radiographer than consult with one of his own kind.

"This is one problem for which I trust our society can suggest a remedy. It unquestionably behooves us all to conduct our work along lines that are compatible with the highest ideals in medicine and surgery, in order that we may merit the full confidence of our medical confreres.

"The present state laws of compensation for injured employees have brought into being a number of insurance companies that are making free use of the x-rays for examination purposes. While a few of these companies pay a fairly reasonable price for x-ray work, the majority go shopping for cheap x-ray men who will do job lot work at a ridiculously low figure. These companies, when they are made to realize that they are not paying for glassware at so much per dozen, but are seeking diagnoses and prognoses and competent medical advice based upon proper x-ray studies, may be induced to pay a fee consistent with the value of services rendered.

"Apropos of this subject there recently walked into my office a distinguished looking person whose card read, Dr. ——————, Rœntgenologist .... Hospital, ... As this hospital was well known, I made haste to meet the gentleman and play the 'host gallant.' The doctor seemed well informed upon all matters rœntgenologic and spoke fluently of meetings attended and clinics visited in the large centers. After a hearty lunch at my most expensive club, I casually inquired of the doctor as to his alma mater and was

both surprised and chagrined to learn that he was not a medical man. He stated frankly that he had been an automobile salesman, had a fair knowledge of photography and through a political friend had secured his present position. It is perhaps needless to say that my interest in this man suddenly ceased and the incident is mentioned only to recall the painful fact that a man of this type is placed upon the same level as you and me, solely because he has learned to make mechanically good x-ray plates."

The same problem confronts the dental profession so far as rœntgenology is concerned. In all of our large cities, dental picture galleries have been established which for the main part are presided over by mechanics; and strange as it may seem, many apparently intelligent and sincere dentists refer their cases to such laboratories. Such action on the part of these dentists is certainly out of keeping with professional procedures. The making of radiographs is one thing, and the interpretation of these same radiographs is another thing. And the man who is not well grounded in anatomy, physiology and pathology, has no moral right to attempt to interpret any radiograph, even though he have ability along mechanical lines and is thoroughly familiar with the technic of radiography.

It is to be hoped that the time will come when legislation may be enacted which will put a stop to these medical and dental picture galleries, unless they can be presided over by men fully qualified and licensed in the particular field in which the radiographs are to be applied.

American Institute of Dental Teachers

THE next annual meeting of the American Institute of Dental Teachers will be held at Hotel Adelphi, Philadelphia, Pa., January 23, 24, 25, 1917.

A number of papers, reports and discussions relating especially to dental education will mark this meeting. All dental teachers are cordially invited to be present.

Abram Hoffman, Secretary.

529 Franklin Street, Buffalo, N. Y.

The International Journal of Orthodontia

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ORIGINAL ARTICLES

A STUDY OF THE CUBIC CAPACITY AND SUPERFICIAL AREA OF THE MAXILLARY SINUS

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DURING June, 1912, the writer read a paper before the section on Stomatology of the American Medical Association at Atlantic City, in which he reported measurements he had made in studying the cubic capacity and superficial area of the maxillary sinuses in twenty-one heads.[1] At the time this paper was presented, the original casts, the photographs of which accompany this article, were shown. Because of the interest which orthodontists have in the anatomy of the face and particularly the jaw, it was thought advisable to add some observations which were not recorded at that time.

The maxillary sinus (Antrum of Highmore) has been studied ***in situ***, from an anatomic standpoint, by many men; but few have attempted accurately to reproduce the sinus in some concrete form and make observations of it in this manner. Some have determined the cubical capacity of several pairs of these sinuses and were forced to destroy the heads in making the observations, but, so far, no report has been made in the literature of the superficial area of the sinus.

The report here presented is the result of a study made on the maxillary sinuses in which I have determined the cubic capacity and superficial areas of twenty-one pairs without destroying the original heads. This work is based on the method used by H. W. Loeb[2] in studies of the sphenoid sinus, presented before the Third International Laryngo-Rhinological Congress at Berlin, August, 1911.

MATERIAL.

The heads used in the study here presented were preserved by injecting a fifty per cent dilution of liquor formaldehydi through the carotid; they were

[1]Jour. Amer. Med. Assn., Aug. 3, 1912.
[2]Loeb, H. W.: Ann. Otol., Rhinol. and Laryngol., March, 1912.

decalcified by soaking in a three per cent solution of hydrochloric acid for from three to five months. They were then cut horizontally in sections about one inch thick by means of a very sharp knife. These heads are from the Anatom-

Head III. Exact size.

Head IV. Exact size.

Head V. Exact size.

ical Department of the St. Louis University. All were heads of adults, and in no instance was it possible to ascertain any history of the individual.

METHODS OF MAKING PLASTER CASTS AND THEIR GROSS APPEARANCE.

The portion of the sinus lying within the adjacent sections was filled with soft plaster-of-Paris which when hardened was removed and the adjacent por-

Head VI. Exact size.

Head VII. Exact size.

tions united with a thin layer of very soft plaster. This finally resulted in a complete cast of each sinus.

The plaster casts, forty-two in number, representing twenty-one heads, give a clear idea of the size, form and irregular contour of the sinuses. These casts are mounted in pairs and show the relation of the right and left sides.

The right and left of each pair of sinuses are more or less symmetrical, but vary in size. They are roughly triangular in shape with the apex posterior, and with all the walls practically triangular except the internal, which is more or less quadrilateral. While the two sinuses of one head usually are similar, they differ materially from those of any other head.

In photographing the casts, a great deal of the detail has been lost. Each

sinus is very irregular, which increases the superficial area. Because of this many of the casts which appear smaller than others may have a greater superficial area.

Head VIII. Exact size

Head X. Exact size.

Head XI. Exact size.

CUBIC CAPACITY.

The measurement of the displacement of water resulting from the immersion of a body in water gives the volume of cubic capacity.

Since these casts are made of a porous material, they were first allowed to remain for several minutes in melted paraffin so that the interspaces might be

made impervious to water. After this the cubic capacity was ascertained volumetrically as follows:

HEAD	RIGHT IN C.C.	LEFT IN C.C.
III	8.0	7.5
IV	24.8	24.5
V	24.5	19.2
VI	16.8	13.0
VII	13.9	14.5
VIII	7.0	4.9
X	10.2	10.0
XI	14.5	15.2
XII	10.0	7.2
XIV	13.0	14.8
XV	13.0	9.6
XVI	4.5	4.8
XVII	12.0	8.0
XVIII	11.5	4.8
XIX	12.5	18.5
XX	14.9	15.2
XXII	14.7	8.5
XXVIII	11.0	9.0
XXIX	8.5	7.5
XXX	18.3	15.0
XXXI	9.5	6.2
Average	13.02	12.85

The general average was 12.94 c.c.

Head XII. Exact size.

Head XIV. Exact size.

These results show the extremes to be head 16 right, 4.5 c.c., and head 4 right, 24.8 c.c. The average, however, of the right side is very near that of the left.

SUPERFICIAL AREA.

Adhesive plaster as used by H. W. Loeb, in connection with the superficial area of the sphenoid sinuses, was employed in determining the superficial area of the maxillary sinuses. A strip equaling 25 sq. cm. (5x5) was placed

Head xv. Exact size.

with the adhesive part down, on a small plate of glass, without stretching. With a sharp knife pieces were cut and fitted on each cast until it was entirely covered, care being taken that the pieces did not overlap.

It is safe to say that this method is not subject to an error of two per cent; in fact, it is more than likely that there is not more than 0.5 per cent of error.

The results in square centimeters are as follows:

HEAD	RIGHT	LEFT
III	25.9	25.2
IV	52.3	48.4
V	51.3	45.8
VI	43.1	37.0
VII	34.2	37.7
VIII	27.7	21.2
X	29.0	29.7
XI	35.1	39.9
XII	28.3	22.4
XIV	35.2	35.0
XV	33.1	28.6
XVI	12.1	16.3
XVII	30.0	25.0
XVIII	34.2	16.5
XIX	31.0	40.0
XX	33.1	33.1
XXII	36.9	27.3
XXVIII	29.1	26.3
XXIX	25.9	25.9
XXX	41.4	38.1
XXXI	27.4	21.0
Average	32.91	30.43

The general average of all the sinuses is 31.68 sq. cm., showing a marked uniformity in the two sides. The extremes are head 16 right, 12.1 sq.cm., and head 4 right, 52.3 sq. cm.

From a comparison of the photographs of the various groups of sinuses, and from the actual measurements as recorded, one is struck with the extreme

Head XVI. Exact size.

Head XVII. Exact size.

Head XVIII. Exact size.

variations in the size and shape of the sinuses in the respective heads. This could not be anticipated from an observation of the heads used before the sinuses were exposed. There seemed to be no connection whatever between the size of the head or contour of the face, and the size or shape of the sinuses.

Very large heads with broad faces often possessed small sinuses, and vice versa. There were no landmarks or signs of any kind which would aid in any way in determining the form or size of the sinuses before they were exposed. No definite reason can be given for this variation in size and shape.

Head xix. Exact size.

Head xx. Exact size.

Head xxii. Exact size.

The shape of the palatal arch gave no information as to the formation of the sinuses. Heads showing narrow, constricted, high palatal arches where a

narrowing of the sinuses might well be expected, often had very large, or at least the normal size sinuses.

The question is often asked by orthodontists whether or not the expansion of the dental arch affects the size of the maxillary sinus in any way. While my observations were not made with this point in view, I doubt very much whether

Head XXVIII. Exact size.

Head XXIX. Exact size.

Head XXX. Exact size.

this expansion has any effect whatever on the sinus. In most cases the actual increase in size takes place along the midline of the palate and not in the sinus

region. New bone tissue, the formation of which is stimulated by this expansion, is most probably developed along the line of expansion and in the alveolar process.

In making the observations the roots of only a few teeth were found to

Head xxxi. Exact size.

penetrate actually into the sinus. These were principally of the first and second molar teeth. It was not at all uncommon, however, to find only the frailest partition of bone over the apices of teeth. Abscesses of such teeth might easily have affected the sinus.

THE USE OF THE LINGUAL ARCH IN THE TREATMENT OF MALOCCLUSION AS USED BY DR. LLOYD S. LOURIE*

By Martin Dewey, D.D.S., M.D., Kansas City, Mo.

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In the first installment* of this series of articles on the use of the lingual arch as employed by Dr. Lourie, I mentioned some of the advantages of the lingual arch in combination with the labial arch as compared with other appliances. In this installment, I will show a number of models of different types of malocclusion, treated with the aid of the lingual arch, which have been taken from Dr. Lourie's practice. The lingual arch has been used on all of these cases either alone or in combination with the modified labial arch. The cases shown are only a few of the large number which he has in his practice and have been selected as typical types of malocclusion with which we all are familiar.

Fig. 1 shows the front view of the model of a patient six years of age, with an underdeveloped upper and lower arch; the lower arch being slightly distal. Fig. 2 shows the occlusal view of the upper arch with a bunching of the deciduous incisors; a lack of development between the upper canines. There is also a crowding of the lower permanent incisors which can be seen in Fig. 1. This

*The Lingual Arch in Combination with the Labial Arch with Extensions as Used by Dr. Lloyd S. Lourie, International Journal of Orthodontia, vol. ii, p. 593.

crowding is the result of the lack of development of the lower arch which in turn is also retarded by the lack of development of the upper arch. The lingual alignment wire was placed on the upper arch, as shown in Fig. 3, with bands upon the deciduous molars. By pinching the lingual alignment wire in the incisal portion, the angles which rest against the deciduous canines were carried away from each other, resulting in expansion in the canine region,

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

which would also cause some expansion of the molars. As the upper dental arch was widened, giving more room for the lower arch, the lower arch grew and the teeth were forced buccally by the action of the tongue assisted by the force of the inclined plane of the lower teeth with the upper permanent and deciduous molars. As the upper arch was expanded, the lower arch developed forward,—the slight distal relation of the lower to the upper molars changed.

Intermaxillary anchorage was at no time employed to shift the molars and no appliances have ever been used on the lower arch. Up to the present time the conditions shown in Fig. 4 have been brought about by the expansion of the upper dental arch with the lingual alignment wire. This work has been done painlessly and without resorting to the use of bands on any of the anterior teeth. The appliance used was absolutely inconspicuous, the bands being carried on the upper second deciduous molars, consequently the appliance was very easy to clean, simple, practical, and esthetic. It may be necessary later in the treatment to put a lingual arch wire on the lower dental arch to assist the growth of the lower dental apparatus. Up to the present time the expansion of the upper arch along with the force of occlusion has been sufficient to carry the case as rapidly as necessary for normal development.

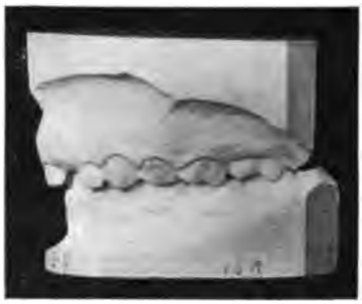

Fig. 5.

Fig. 6.

Fig. 5 shows a side view of a model of a patient, six years of age, in which there is a distal relation of the lower to the upper arch. Fig. 6 shows the occlusal view of the same case before any treatment was attempted. Fig. 7 shows the occlusal view of the upper and lower models with the appliances in position. It will be seen that the lower appliance consists of a lingual alignment wire, the ends of which are soldered to bands fitted on the lower second deciduous molars. On the buccal surface of the lower molar band is soldered a hook which receives the intermaxillary rubber. On the upper teeth an alignment wire with plain bands placed on the upper first molars is so adjusted that it extends forward practically as far as the deciduous canines. In order to insure a labio-buccal movement of the deciduous canines and prevent them from being pushed forward in the expansion of the lingual alignment wire, spurs

were attached to the main body of the alignment wire, which carried these teeth buccally. These lingual alignment wires are made of 19 gauge iridio-platinum, which material is quite hard and most satisfactory for the use of these appliances where the force is obtained by using wire stretchers. On the upper molar bands we have a buccal tube to which has been soldered an extension which reaches as far forward as the canine, and carries a hook to receive the intermaxillary rubber which will give the necessary force to move the lower arch forward. Fig. 8 shows a buccal extension from the upper molar bands, carrying intermaxillary hooks which supply the intermaxillary anchorage. The upper arch has been expanded, the permanent centrals have assumed their correct position, there is room enough for the upper lateral incisors; and the

Fig. 7.

Fig. 8.

Fig. 9.

mesio-distal relation of the arch is practically established. In the treatment of cases at this age where the lower second deciduous molar remains too long or holds the lower molar distally as it frequently does, Lourie often reduces the mesio-distal diameter of the second deciduous molar to assist the lower first permanent molar in taking its proper position and locking normally with the upper first molar. I think almost every practitioner will agree that the use of the lingual arch as shown in this case is much more esthetic than any described heretofore. The expansion of the upper and lower arch has been accomplished and the mesio-distal relation has been corrected, all with the small lingual arch. As mentioned before, the outstanding feature of this arch is that it is entirely inconspicuous, may be easily kept clean, and no bands or ligatures need be employed on the anterior teeth. It is without doubt the most ideal appliance

for the patient's comfort that has ever been devised. The use of these small lingual arches especially on young patients is very desirable as there are no ligatures to be displaced, no unsightly bands, and the slight amount of pressure exerted by the wire stretchers never causes soreness of the teeth. The patient is never annoyed by the use of the lingual appliance, yet it accomplishes exactly what is expected of any regulating appliance, i.e., exerts enough pressure to produce normal development. Another advantage that might be mentioned is the fact that the patient is extremely well pleased because of the inconspicuousness of this appliance, and it certainly has a wonderful effect upon the parents.

During the last two years much has been written regarding the bodily movement of the teeth, and several appliances have been placed upon the market for that purpose. In considering the apical or bodily movement of the tooth, it must be remembered that anchorage must be more secure than if the tooth was simply tipped. Shortly after various appliances were devised for the bodily movement of the teeth, several articles appeared in the dental journals cautioning those who were trying to produce bodily tooth movement to be

Fig. 10. Fig. 11.

careful of their anchorage. It was evident that orthodontists were experiencing much difficulty in getting sufficient anchorage to produce bodily tooth movement. The use of the lingual arch offers great advantages in molar anchorage when apical movement is accomplished. The lingual arch can be used in combination with the labial arch with the spur attachment for bodily movement of the teeth or the apical movement as shown in the next case reported.

Fig. 9 illustrates a case which required expansion with the apical and torsional movement of the lateral incisors, and distal and lingual movement of the upper canine. Fig. 10 shows the occlusal view of the case. In the occlusal view shown in Fig. 11, we have adjusted on the upper first molar plain bands carrying the buccal tube for a 17 gauge arch. The lingual arch is made of 19 gauge iridio-platinum. The spurs were soldered on the lingual arch to bear against the mesio-lingual angle of the upper premolar for the purpose of moving that particular tooth slightly distal when the upper second deciduous molar was lost. It will be noticed that the lingual arch is bent so as to bear against the lateral incisors which are carried labially as a result of the action of the wire stretchers. I have already stated that these lateral incisors require apical movement.

In the treatment of this case the expansion was produced before any apical movement was accomplished; in other words, no attempt was made to move the teeth apically in the beginning of the treatment, because it is a recognized fact that as a result of orthodontic treatment there occurs a development in the tissue surrounding the roots, and very often the teeth which are supposed to require apical movement, straighten up during the process of treatment. From the foregoing statement I would have the reader understand that when mechanical force is brought to bear upon certain teeth which seem to require apical movement, the tissue development will cause the teeth to assume their proper position in the line of occlusion without any mechanical root movement. It is, therefore, better to begin the treatment of these cases by applying mechanical stimulation and then allow Nature to do what she can. If, in the process of treatment, it is found necessary to have apical movement, the teeth can then be moved just as easily, and Nature will have done what she could.

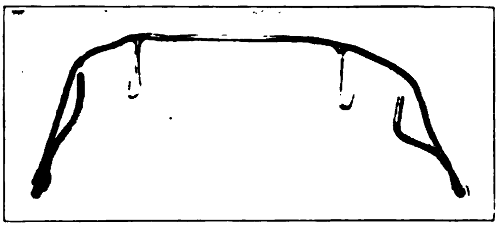

Fig. 12.

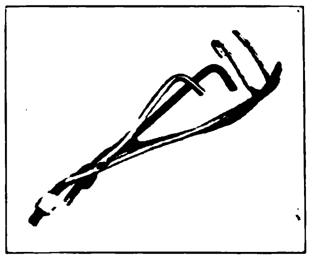

Fig. 13.

Fig. 12 shows a front view of the labial arch. Two spurs with their ends bent to form hooks are attached on the labial arch for the lateral incisors. These hooks are made to engage tubes on the bands which were placed on the lateral incisors for the purpose of rotating the teeth by making the two points of bearing. The labial arch is placed above the gingivus and the spur enters the tube from the occlusal side. This gives a much longer spur, produces a greater amount of elasticity than if it were only a short spur, or an arch placed on the labial surface of the teeth. With the end of the spur bent as a hook and entering the tube from the occlusal side, rotation can be obtained much easier because of the ease of application, plus the long elastic spring of the long spur. Soldered to this labial arch are two extension spurs which also engage two canines for the purpose of moving these canines lingually and distally. By binding these long extension fingers, or springs, force will be brought to bear on the canines and in that manner the direction and degree of movement can be controlled by the expanding and adjusting. We believe that it is of great advantage to have the arches so placed that the long spurs can be used on the lateral incisors (see Fig. 12). In Fig. 13 we have a lateral view of the same appliance as shown in Fig. 12. In discussing this case, Lourie says that at the present time he would use much smaller wire in making the appliance than that used in this case. Fig. 14 illustrates a model of the case which is presented only as a study model and not as a finished result. It shows the manner in which the lateral incisors can be moved and the manner in which the canines can be brought back to their proper position.

In using the lingual arch in combination with the labial arch a great many variations of appliances are employed, the outstanding features of which are their inconspicuousness, esthetic value, and efficiency.

Fig. 15 shows another type of malocclusion treated with the combination of the labial and lingual arches. Plain bands were placed on the upper first molars and the lingual arch was adjusted as shown in Fig. 16. This study model was made during the movement of the teeth and shows considerable movement of the lateral incisors. The lateral incisors were moved forward by pinching the lingual wire on the lateral halves. Small spurs which bear on the linguo-gingival surface of the lateral incisors were soldered to the lingual arch to insure a force directly against the laterals. If, in their movement, the lateral

Fig. 14.

Fig. 15-A.

Fig. 15-B.

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it is possible to rotate these teeth during treatment. Fig. 17 shows the appliance with the labial arch in position with the tube carrying the long lever springs which produce the distal movement of the canine. Figs. 17 and 18 show that there are no extension spurs upon the labial arch during the time the canines are being moved. The advantage of the long spring for the movement of the canine lies in the fact that it is easily adjusted by bending the spring on the canine without disturbing any of the other teeth; in fact, it would have been possible to move the canine at the same time the incisors were moving, and in the adjustment of the spur on the canine there would have been no displace-

Fig. 16.

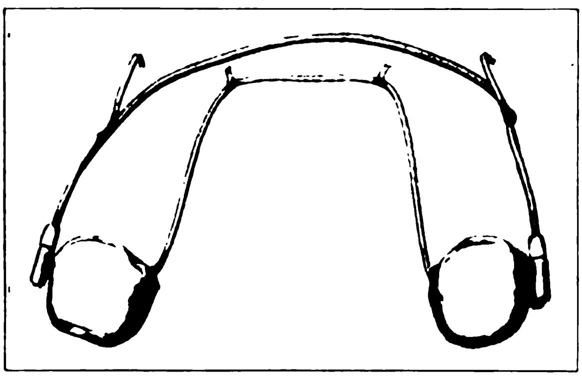

Fig. 17.

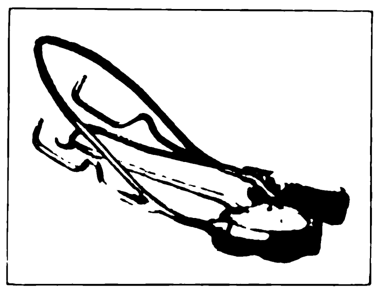

Fig. 18.

ment of the incisors owing to the long spring on the canine. Since the only adjustment necessary was done in the canine spring and as the labial arch was not changed, it was not necessary to disturb any of the other teeth.

Fig. 19 is a front view of the same case made from the study model and shows the position of the spurs on the central incisors for the purpose of producing apical tooth movement. The lingual arch shown in Fig. 16 supports the molars and affords sufficient anchorage for the distal movement of the central incisors. The arch used on this case was 17 gauge, which is smaller than it appears to be on the study model, but it shows the position of the appliance at the time the study model was made. Fig. 20 shows the side view of the study model of the case in the process of treatment. It will be seen that the canine has been brought back to the proper influence of the inclined plane, and the pre-

molars and molars are in their proper positions. It must be remembered that all of this tooth movement has been accomplished with an appliance that is very delicate, and one that is much more pleasing to the eye than some of the bunglesome appliances used for the same purpose.

The use of the lingual and labial arch is not confined to any one type of mal-

Fig. 19.

Fig. 20.

Fig. 21.

Fig. 22.

occlusion, but may be used in a Class II (distoclusion) or Class III (mesioclusion) case with an equal degree of efficiency as used in Class I (neutroclusion). Fig. 21 shows a side view of a case which requires expansion of the upper and lower arch with distal movement of the upper incisors. Fig. 22, a front view of the same case, shows a narrowing of the upper arch in the re-

gion of the canine. In the treatment of this case, plain bands are placed on the upper first molars which carry buccal tubes as shown in Fig. 23-B. The lingual arch is made of 19 gauge iridio-platinum, and is adjusted so as to rest against the linguo-gingival ridge of the upper canine without touching the upper centrals or laterals. The lingual arch rests slightly occlusal to the gingival marginal ridge, and on the lingual inclined plane of the upper canine; and by bending the lingual arch so as to press gingivally on the canine, it produces an elongating force upon the upper molar. This gives a reciprocal action between

Fig. 23-A. Fig. 23-B.

Fig. 24.

Fig. 25.

the expansion of the upper canine, and an elongating of the molars, which, in addition to wire stretching between the canines, produces the necessary tooth movement required in this case.

The lingual arch was adjusted on April 14, 1916, and on April 24 the labial arch was adjusted with extensions to the central incisors, as shown in the accompanying illustrations. On June 21, extension spurs were adjusted on the labial arch for the lateral incisors. The 17 gauge arch was used with 22 gauge extension spurs. The labial arch with extension spurs when placed above the gingivus, gives a very pleasing appearance and an appliance that is inconspicuous. Fig. 24 shows the position of the labial arch with the extension spurs on the centrals and laterals. Fig. 25 shows the change in the mesiodistal relation in the arches, and the change in the angles of the central and

lateral incisors. One of the advantages which I have often mentioned in the use of the lingual arch with the combination of the labial arch and the spur extensions is the pleasing appearance of the appliance, as shown in Fig. 26. These small 22 gauge iridio-platinum spurs running parallel with the long diameter of the teeth are the only parts of the appliance visible, and they touch the teeth only at one point. They are much easier to keep clean than the labial arch resting on the labial surface of the tooth, either with or without the use of the bands.

The lingual arch in combination with the labial arch can be used equally

Fig. 26.

Fig. 27.

as well with intermaxillary rubbers in Class III (mesioclusion) cases or can be used alone with buccal extensions from the lower first molar. Fig. 27 shows a case of mesiooclusion in which the patient has reached that age where she is very sensitive about having a regulating appliance show. The case was treated by adjusting plain bands on the upper first molars and the lingual arch was used, but was made removable, being locked in the lingual tubes by means of a locking device similar to the one known as the Young-Angle Lock. The lower lingual arch is soldered to the lower molar band which also carries a buccal extension (as shown in Fig. 29), to which the intermaxillary rubber is attached from a small hook on the buccal surface of the upper molar band. The

extension of the buccal spur from the lower molar band to the region of the lower first premolar allowed the use of the intermaxillary rubber without any appliance on the anterior teeth that showed from the labial side. The lingual arch used on the upper model was pinched, and produced the expansion necessary; the expansion shown in Figs. 27, 28, 29 was produced by the same 19 gauge lingual arch being used the entire time. The use of this inconspicuous appliance in this mesioclusion case enabled the patient to wear it without being sub-

Fig. 28.

Fig. 29.

jected to embarrassment. I do not believe that any other appliance could have been used which would have been as inconspicuous or of as little annoyance to the patient.

MODIFICATION OF THE LINGUAL AND LABIAL COMBINATION.

The reader should bear in mind that the cases shown in this article are those which have been under treatment, and the study models are presented in order to show the actual appearance or position of the appliance on the case. It must be remembered that an appliance shown on a study model necessarily appears more bulky than it actually is. In using the lingual arch made of 19 gauge iridio-platinum, individual spurs can be soldered to it to bear against the gingival marginal ridge of each tooth. These spurs are bent in such a manner as to be entirely free of the gingival gum tissue, and still the individual spurs can

be pinched by the wire stretchers, thus exerting force on the individual tooth without disturbing the rest of the teeth. By pinching and bending the lingual arch as a whole, various movements can be accomplished on one or both sides. and the molar and premolars can be moved as desired with the lingual arch, as shown in Fig. 30. No spurs are shown upon the premolars, but if desired, they can be made to rest against the lingual surface of the premolars which can then be expanded individually or as a group. The labial arch shown on the study models of the cases reported in this article is a 17 gauge gold and platinum arch which was originally an ordinary expansion arch with screw and nut attachments. As there is little use for the nut and screw, the labial arch as

Fig. 30.

Fig. 31.

now used by Lourie, consists simply of a 19 gauge iridio-platinum wire carrying 22 gauge gold and platinum spur extensions. Gold and platinum spurs of 22 gauge are used because this material possesses a greater elasticity or spring than iridio-platinum. The labial arch is bent gingivally, mesial to the buccal tube with the result that the entire labial arch lies high on the gingivus (as shown in Fig. 31) with much less annoyance to the patient in that position than an arch that rests on the gingival border of the teeth. These improvements and changes make the appliance practically inconspicuous, as shown in Fig. 26.

The advantages of this appliance, from an esthetic standpoint and also from the point of cleanliness for the patient, surely causes it to more nearly fulfill the ideal conditions of a regulating appliance than anything we have had heretofore. Yet with all its advantages, this appliance must be prop-

erly manipulated in order to secure the best results, and the operator who desires to use it should be absolute master of the mechanics of bending and stretching the wire in various directions and the effects of the spring should be thoroughly understood, or it will be as troublesome as it can be made useful. However, the ease with which patients wear these appliances, and the source of satisfaction that patients who have worn other appliances derive from them, is certainly a strong recommendation of their practicability.

THE PRACTICAL USE OF TUNGSTEN AND MOLYBDENUM IN ORTHODONTIC APPLIANCES.

By H. C. Pollock, D.D.S., St. Louis.

AMONG the orthodontic appliances in use at the present time, there is one usually referred to as the expansion arch, or, as some operators prefer to designate it, the alignment wire, which has assumed an important role in orthodontic equipment. It still possesses some very valuable advantages in the treatment of malocclusion and seems to retain its popularity.

Within the last few years, we have had several modifications of the expansion arch advocated, and appliances based upon entirely different scientific principles have taken their places in orthodontic technic, however it still remains that the combination of force,—the jackscrew combined with spring energy as exemplified in the expansion arch—enjoys a very prominent place in most orthodontic practices.

Expansion arches, in the past, in order to meet their requirements, have been for the most part made of German silver together with its various combinations of alloys. It has probably been used more extensively than any other material for such purposes. Some of the advantages claimed for the base metal arch may be mentioned as follows:

1. That it is capable of being tempered to the point which will enable it to exert the desired amount of elasticity; that its efforts to release itself like a coiled spring, when adapted to the teeth, may be controlled by tempering or releasing its temper as is indicated during treatment.

2. That this base metal material exerts an antiseptic influence at the points where it comes in contact with the tooth structure, and this feature in many instances serves as a protection to the tooth, whereas, if a noble metal were used, caries might gain favorable access. Together with its advantages, there are so many disadvantages in connection with the use of base metal as an expansion arch, that to say the least, any material which will adequately meet all the requirements of an arch and eliminate the undesirable features of base metal, is to be desired. Some of the more conspicuous objections to German silver and its alloys as an arch material might be here pointed out. The gold plating with which these appliances are usually plated, soon vanishes when in practical use; the appliance oxidizes and exposes a surface which is not only unsightly in appearance, but is decidedly offensive from an esthetic standpoint.

3. Soft solder must be used for the attachments placed upon this mate-

rial for a Baker anchorage or for spurs, because the temperature required to fuse a higher grade of solder entirely releases the spring energy of the arch.

4. We have some base metal appliances on the market which are made of brass, pure and simple, being gold plated; and the objections to brass to be used in the mouth are only too obvious to be worthy of further comment.

Various forms of precious metals are used quite extensively, among which may be mentioned platinum and gold, including various alloys of these metals, also alloys of platinum and iridium. These possess many advantages over the base metals, among which are those of presenting a better esthetic appearance, and they may be used in smaller gauges which allow them to retain their rigidity. Attachments may be secured to the noble metal appliances with gold solder without working injury to their rigidity; nevertheless, these precious metal arches in practical use must also come in for their share of criticism. In some mouths it is claimed precious metal appliances of gold and platinum discolor; that the same being in contact with tooth structure for a long period of time and having no antiseptic qualities encourage decay and discoloration of the teeth. It seems to be very difficult to draw platinum and gold alloy wire down to the small gauge which is desired for delicacy and appearance, and at the same time to retain the rigidity which is so essential and without which any arch no matter of what material constructed, used as an alignment wire, is utterly inadequate, and usually proves a failure in practical use. The basic principles of an expansion arch to be used for moving teeth are rigidity and elasticity, and when utilizing the principles of tooth movement which require attachments of flexible ligature to the teeth to be moved, the above requirements are most essential; and the writer believes that the metal tungsten drawn down to wire form more nearly answers these requirements with less bulk than does any other material that we have at the present time. The use of tungsten and molybdenum as orthodontic appliances was first advocated by Weston A. Price, D.D.S., and Frank A. Fahrenwald, E.M., after some very complete research by the Scientific Foundation and Research Commission of the National Dental Association, the report of which work points out some very interesting attributes of these metals.

After having used tungsten and molybdenum for a considerable time in practical clinical work, the writer believes the former to be far superior for various forms of expansion arches than any metal which has previously been used for the purpose, as it manifests some desirable characteristics which no other metal offers in practical use.

The elastic content of tungsten being about twice that of steel, its melting point nearly twice that of platinum, its stiffness about six times that of 30% iridium in platinum, also the quality that it does not anneal or lose its stiffness and elasticity at tremendous heat, makes it particularly adaptable for some of the uses of the orthodontist.

The elasticity and the rigidity of tungsten is so great that, used as an ordinary expansion arch, the gauge may be reduced as low as .022; however, with a diameter of .030 (about 21 gauge) it manifests ample elasticity for correcting most cases of malocclusion, in fact, exerts as much "kick" as does iridio-platinum, gold alloy, or German silver of much heavier gauges and sizes. The

In the treatment of this case the expansion was produced before any apical movement was accomplished; in other words, no attempt was made to move the teeth apically in the beginning of the treatment, because it is a recognized fact that as a result of orthodontic treatment there occurs a development in the tissue surrounding the roots, and very often the teeth which are supposed to require apical movement, straighten up during the process of treatment. From the foregoing statement I would have the reader understand that when mechanical force is brought to bear upon certain teeth which seem to require apical movement, the tissue development will cause the teeth to assume their proper position in the line of occlusion without any mechanical root movement. It is, therefore, better to begin the treatment of these cases by applying mechanical stimulation and then allow Nature to do what she can. If, in the process of treatment, it is found necessary to have apical movement, the teeth can then be moved just as easily, and Nature will have done what she could.

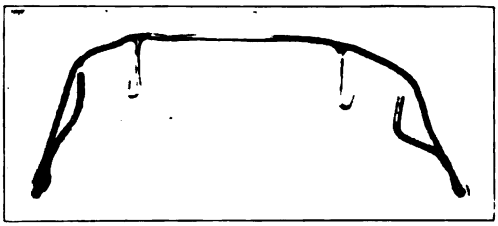

Fig. 12.

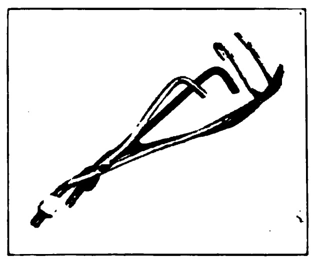

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Fig. 14.

Fig. 15-A.

Fig. 15-B.

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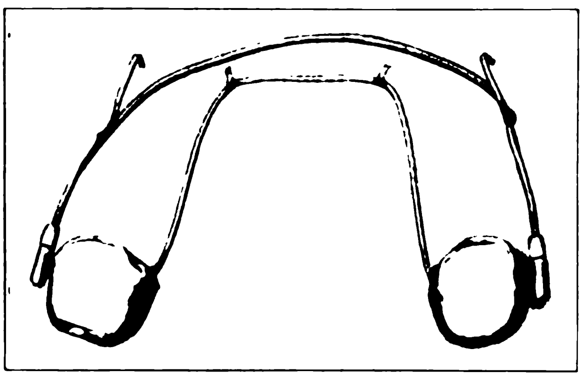

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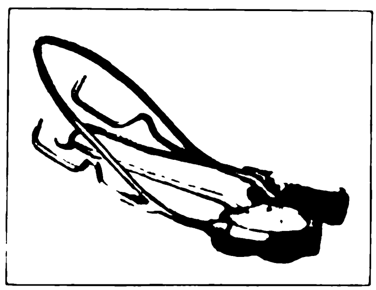

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vantage in retaining appliances may be secured by adjusting the retainer, from time to time, to produce any further shifting or fixing of the teeth which may be desired. Attachments may be made to the individual tooth, which attachment are flexible and allow the teeth to respond to the forces of occlusion; but as the tungsten is strong, it still retains ample rigidity, and without the fixed soldered attachments to the retaining bands. In the report of the Research Commission on tungsten and molybdenum, some further qualities of these metals are pointed out: "Tungsten has a hardness so great (so we are informed by the General Electric Co.) that a specially prepared phonographic needle point from it will outwear two hundred steel points; will draw to a finer wire than any known metal; has a tensile strength thirty times that of gold and ten times that of iron; is not affected by ordinary acids or alkalies, except hydrogen dioxide, in which it is soluble. Its melting point is over 3.000 degrees C. or 5.400 degrees F., and is from six to seven times as stiff as iridio-platinum." The prop-

Fig. 6.—End section of Angle pin tube appliance, to which may be soldered tungsten wire.

erties of the coated material as reported by F. A. Fahrenwald indicates that it has the surface properties of pure gold or its alloys, together with the original properties of pure tungsten, a combination which can not be approached by any other metal or alloy at the present time available.

This is because of the great strength and stiffness of the new material and due to the fact it can be soldered or otherwise manipulated at high temperatures without softening or losing this stiffness and elasticity in the slightest degree, however, there can be some treacherous spots still found in the coated tungsten wire.

The chief objections to this material are its brittleness and unreliability in the larger sizes, but this objection is gradually being remedied in the experimental department of the Research Commission of the National Dental Association.

Molybdenum is quite satisfactory to be used in conjunction with the loop appliances, which has been described and advocated by Dewey and others. Fig. 5 shows a molybdenum arch wire in place having two loops placed in it at such

points that it may be adjusted from time to time by the bending and manipulation of these loops being used in conjunction with the well known Young attachment on the molar bands, or the attachment seen in the cut. This form of attachment on the anchor bands facilitates ease and convenience in making adjustments, as the arch can be very quickly removed and all manipulating done when detached from its anchorage. By using the pliers as illustrated in Fig. 1, designed particularly for this purpose by Federspiel, the loops are quickly and accurately made. Molybdenum bends easily, yet it is sufficiently rigid to retain its position under the stress of mastication.

The price of gold or gold and palladium plated tungsten is about one-fifth that of platinum, or one-sixth that of iridio-platinum. The price of molybdenum gold or gold and palladium coated is about one-eighth that of platinum or one-half that of iridio-platinum. The materials, tungsten, and molybdenum for use in the newer forms of appliances, which control the bodily movement of teeth, have in the writer's experience proved thoroughly adequate only as a working retainer. In this latter capacity, tungsten has proved, in a few cases, quite effective, as its rigidity allows no flexing backward and forward of the roots of the teeth. It has been used to great advantage in the retention of Class II, Division 1 cases, where it has been desired to move the lower incisors bodily in the labial direction, advancing the labial plate of compact bone *en masse*.

Fig. 3 shows a tungsten arch in position to be used in conjunction with a Baker anchorage for shifting the occlusion.

The above outlines the advantages and the conclusions reached by the writer upon the relative merits of these metals used for orthodontic purposes through an experimental stage of a considerable length of time and as such, experience convinces him that these materials solve some of the many difficulties in treatment. No doubt, the experience of others will develop some very desirable and welcome ideas in the use of tungsten and molybdenum, which, as yet, are obscure but offer great possibilities of development in future orthodontic technic.

BIBLIOGRAPHY.

Fahrenwald, F. A.: A Development of Practical Substitutes for Platinum and Its Alloys with Special Reference to Alloys of Tungsten and Molybdenum, Journal of the National Dental Association, March, 1916.

Dewey, Martin: Practical Orthodontia, St. Louis, 1915.

American Institute of Dental Teachers

THE next annual meeting of the American Institute of Dental Teachers will be held at Hotel Adelphi, Philadelphia, Pa., January 23, 24, 25, 1917.

A number of papers, reports and discussions relating especially to dental education will mark this meeting. All dental teachers are cordially invited to be present.

ABRAM HOFFMAN, Secretary.

529 Franklin Street, Buffalo, N. Y.

THE DEVELOPMENT OF THE MANDIBLE AS A RESULT OF TREATMENT OF THE PROTRUDING UPPER INCISORS AND DISTOCLUSION OF THE ARCH

By W. A. McCarter, D.D.S., Topeka, Kansas.

THERE are two types of malocclusion which cause a very similar facial deformity, one being distal occlusion of the lower arch, or Class II, Division 1, and the other neutroclusion, with an underdeveloped mandible and protruding upper incisors. The etiological factors of either one of the cases are very much the same, as mouth breathing has probably been the principal cause of these types of malocclusion, with the resulting facial deformity. The treatment of these cases is decidedly different so far as handling of the parts is concerned; however, the thing to be desired in both cases is the development of the mandible.

There has been considerable dispute whether an actual lengthening of the mandible can be produced as a result of the treatment of the malocclusion, and in presenting this case, we do so to add to the evidence we should gather in the consideration of this question. There has been some claim that in the treatment of distoclusion the seeming lengthening of the mandible which we accomplish as a finished result, has been caused by the movement of the condyle forward in the glenoid fossa and is not produced by the development of the body of the mandible. In these neutroclusion cases where the mandible is underdeveloped there is no attempt made to move the mandible forward which could easily be detected by changing the position of the molars; therefore, what lengthening of the mandible occurs as a result of orthodontic treatment is produced by the growth of the body of the mandible from the ramus to the point of the chin.

Fig. 1.

Fig. 1 gives a front and side view of the model, showing that the upper arch is very narrow, that the upper incisors are lengthening and protruding, and that the length of the lower incisors is very marked. There is no abnormal mesio-distal relation of the molars, which indicates that there is neutroclusion of the two arches, with an underdeveloped mandible and protruding upper incisors. It will be seen that there is a great difference in the length of these two arches, as shown in Fig. 2.

The patient, a boy, was eleven and a half years of age at the time the impression was taken, showing a lack of proper nourishment as a result of the malocclusion, making it impossible for him to masticate his food properly. In the treatment of this case, the clamp bands were placed on the upper and lower first molars. The alignment wire was adjusted to the upper teeth, the anterior portion resting against the upper incisors. The lower alignment wire was adjusted to the anterior teeth. An intermaxillary rubber was used and extended from an intermaxillary hook on the upper alignment wire about the region of the canine to the distal portion of the tube on the lower band. The intermaxillary rubber was used to accomplish two purposes; first, its attachment to the upper anterior teeth was to reduce the protrusion of these teeth, and second, it was employed to move the lower arch forward.

Fig. 2.

Fig. 3.

Fig. 3 shows a front and side view of the model of the same case after treatment. This impression was taken when the arches were removed and the retaining appliances adjusted. The retaining appliance is applied only on the lower arch as the occlusion and normal lip pressure was sufficient to keep the upper teeth in their proper position.

Fig. 4 shows a front and side view of the patient at the time of the completion of the treatment. This picture is unique in that the front and side views of the patient are photographed on the same plate at the same time by the use of a large mirror. The patient is so placed that he faces the camera and the mirror is so placed that the reflection of the profile is shown in the mirror in such a manner as to be transmitted to the photographic plate, as shown in Fig. 4. This method of taking photographs makes only one exposure necessary and is much more convenient in making a lantern slide than where we have a separate profile and a front view to be made on one side. It also insures that the

profile and the front views will be uniform in size. There is also an advantage in making a case record by this method, for both the front and side view are on one picture, and consequently we have only half as many pictures to look after as would be the case when the front and side views are on different negatives. By studying this case it will be seen that the mandible has been lengthened as a result of the orthodontic treatment, much more than the forward movement of the lower molars and cannot be the result of the mandible changing in the glenoid fossa.

THE REPORT OF A DISTOCLUSION CASE WITH AN UNIQUE METHOD OF PHOTOGRAPHING THE MODELS.

The case shown in Fig. 5 is that of distoclusion or Class II, with protruding upper incisors and abnormal lip action. As a result of the abnormal

Fig. 4.—Showing an unique method of photographing the front and side view of the patient on the same plate at the same time by the use of a large mirror.

action of the lips, the upper central incisors have been separated for a considerable distance and the teeth are made prominent by the pressure of the lower lip. This case was treated by the use of the clamp bands upon the first molars and ordinary alignment wires. The upper alignment wire was applied with the anterior portion of the wire resting against the upper incisors and the nut standing away from the tube on the upper molar bands. The lower alignment wire was adjusted to the anterior teeth in the lower arch for the purpose of moving the lower arch forward *en masse* without destroying the proximal contact of the teeth or allowing very much tipping of the incisors. At the time the intermaxillary rubbers were applied, ligatures were also placed on the premolars and canines for the purpose of expanding the upper arch as the upper anterior teeth were moved posteriorly by the action of the intermaxillary rubbers. As the upper canines and premolars were expanded

the upper incisors were moved distally or posteriorly and when they occupied the proper position so as to make the upper dental arch a normal shaped arch the nuts were then screwed distally on the upper alignment wire and rested against the anterior portion of the tube on the molar band. This makes all the upper teeth serve as anchorage against the lower teeth which were being moved

Fig. 5.

Fig. 6.

forward by the action of the intermaxillary rubbers. The use of the intermaxillary rubber continued to move the lower teeth forward until they assumed the position shown in Fig. 6, at which point they were retained. The case was retained by the use of the intermaxillary retention described under the treatment of Class II, Division 1, cases in Dewey's "Practical Orthodontia."

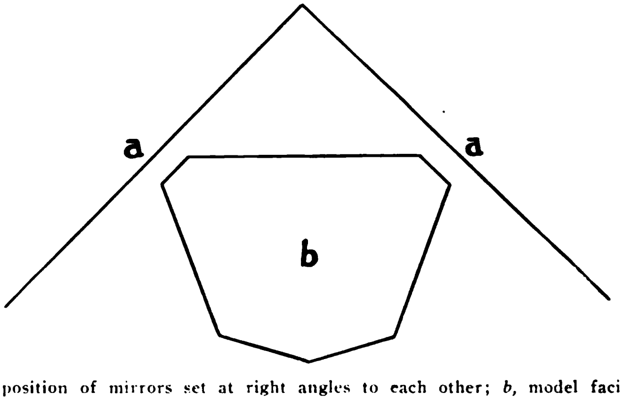

Fig. 7.—*a*, position of mirrors set at right angles to each other; *b*, model facing camera.

Figs. 5 and 6 were made by photographing the models with the use of two mirrors. The model is set with the front facing the camera and behind the model two mirrors are placed which join together at right angles as shown in Fig. 7. The reflection from the mirrors makes the image appear in the camera a double profile view as shown in Figs. 5 and 6. In experimenting

with this form of photographing I have secured the best results with cheap mirrors. Plate glass mirrors seem to throw a halo around the model. Whether this has been the fault of the mirror or has been due to faulty negatives I do not know; however, my experience has been in favor of the cheap mirrors. This method of photographing three models on one plate by a single exposure with the models arranged as in Figs 5 and 6 is especially a good time saver if lantern slides of the case are to be made. The photographs from which the cuts are made are probably too small but they were made this size so that the lantern slides could be made by contrast. If the photographs were made on a larger plate, they would have to be reduced in the making of the lantern slides, which could be done easily enough with the use of the lantern slide or enlarging camera.

This technic in photographing was first shown before the 1916 meeting of the American Society of Orthodontists in Pittsburgh and I believe it will be found a great time saver for orthodontists who are taking their own photographs. It will be a great financial saving for those men who are having their work done by commercial photographers. With a little time and by learning the technic, any one will be able to take photographs of the patient and of his model as is shown in this case and the case previously reported.

NORMAN GREENE REOCH, D.M.D.

By Mark D. Littig, D.D.S., M.D., and Frederick A. Keys, D.M.D.

"The hand of the reaper
Takes the ears that are hoary,
But the voice of the weeper
Wails manhood in glory."

"The autumn winds rushing
Waft the leaves that are serest,
But our flower was in flushing
When blighting was nearest."
—Scott.

"On Thursday, May 5th, at 10 o'clock P. M., Doctor Norman Reoch died." Such was the message that shocked and grieved his friends on the following morning. Blessed with a rugged constitution and enjoying the best of health, the suddenness of his death remains a mournful mystery to his hosts of friends.

Doctor Norman Green Reoch was born at Riverpoint, in the town of West Warwick, Rhode Island, on October 20, 1879. He was the second youngest of a family of five boys and three girls. His mother's name was Helen Stewart, and his father's name Robert Reoch. Both father and mother came from Burrhead, a large industrial town about seven miles west of the City of Glasgow, Scotland.

At five years of age Norman was sent to a private kindergarten school,

where he remained for three years. In his eighth year he attended the Phenix Grammar School, where he remained for three years. In 1890 in his eleventh year he entered the English and Classical School in the City of Providence, spending three years in the Junior and four years in the Senior department. He graduated with high honors from this institution in 1897. In the fall of this same year he entered Harvard Dental College, graduating in 1901. He was the youngest graduate in his class. Doctor Walter Kenyon of Providence, the family dentist, strongly urged his father to train him as a specialist. As a result Dr. Reoch entered upon a course of orthodontia under Doctor Angle in St. Louis. He remained in St. Louis two years, the second year as Doctor Angle's assistant. He also spent some time in Chicago and Detroit at Doctor Angle's suggestion, to obtain some knowledge of office practice and routine. In the fall of 1900, in his twenty-fourth year, he opened offices in Warren Chambers, Boston, where he remained till his death. Soon after starting to practice in Boston he became an assistant instructor in Harvard Dental College, which position he retained for several years. He was connected with the Forsythe Infirmary as "Consulting Orthodontist."

From childhood Doctor Reoch was a lovable boy, a favorite with his playmates and school companions, generous and unselfish in the extreme, and these characteristics remained with him all through life. He was the possessor of a pleasing personality which gained him friends wherever he went. He was naturally unobtrusive, and though possessed of talents much beyond the average, he shunned rather than sought notoriety, never cared to push himself forward or felt "puffed up" with pride on account of his attainments, and would invariably stand aside and give way to others, rather than attempt to stand in the way of their preferment.

Among other memoirs contributed by his father is the interesting fact that he had a natural gift for drawing, which was quite remarkable, and when only a boy entering his teens produced some landscape scenes in crayon work which were most creditable. The only lessons he ever received in drawing were obtained from the village barber, who also had a natural taste for drawing and painting, which was wholly self-acquired. At the Kent County Agricultural Fair in Rhode Island, Norman in his thirteenth year, took first prize in a drawing competition for children under sixteen years of age. In the following year at the Rhode Island State Fair he also took first prize. The picture he exhibited on this occasion was a pastel representing a woodland scene. These two pictures are framed and adorn the walls of his father's home today.

When about eight years of age Norman began the study of the violin, and soon developed a wonderful aptitude for that instrument. When he entered Harvard in 1897 he was a very proficient violinist. While in college he became a member of and played first violin in the Pierian Sodality, the largest musical club of the college.

Norman was always fond of athletic sports of all kinds, and particularly fond of swimming. This led to a sad episode in his career while at Harvard. He and his roommate at college, Mr. Joseph W. Smith, of Andover, a young man of great promise, went off on a canoeing trip in Maine during their vaca-

tion in the summer of 1900. All went well until their return trip on the Bay of Naples, when a sudden squall struck them, and capsized the canoe with all their camp equipment, etc. The two young men at first strove to save all the floating wreckage, but squall after squall struck them, separating them far apart from the upturned canoe, and in this plight Smith was seized with cramps and disappeared. Norman was rescued in an exhausted condition, but young Smith was drowned. It is interesting to note that Mr. Reoch thought that this sad experience would surely cure his son Norman of his extreme fondness for the water, this being his third rescue from drowning, and it was often remarked at home that in whatever way his death was destined to take place it was evidently not to be by drowning; yet after all, Norman's love of the water was without doubt the indirect cause of his untimely death.

On the afternoon of his death Doctor Reoch found recreation in cutting the lawn of his Winthrop home. The warm weather moved him to follow the strenuous exercise by a swim in the ocean. The cold water caused him to experience some discomfort, but to a man of his physique and excellent health this seemed of no consequence. He motored to the city, spent an hour in his office (completing several retaining appliances for children who were leaving for the summer), and left the building at eight o'clock in his usual happy mood and apparently in the best of health. Returning to his home he played with his little nephew and his pet dog, bade his wife good night, and retired. But before he could have passed into the refreshing sleep of night he passed into that sleep from which there is no awakening. His splendid physical condition saved him from death in the ocean, but death came to him in sleep, without warning to himself, to his family or to his friends. Could we who knew him, we who respected and loved him, we who know his virtues and his accomplishments, we who have had the privilege of his friendship, experience a greater shock? Well do we remember his return to Boston, at a time when Orthodontia was not recognized as a specialty. He received no encouragement in his intention to specialize, but he "promised Doctor Angle that he would practice orthodontia as a specialty," and he kept his promise. He became one of Boston's first orthodontists. He had a large and lucrative practice—a practice of children who loved him, children whose appreciative parents believed in him and in his ability. He had the respect and confidence of his professional brethren. He was a member of many dental societies, among which are Massachusetts and National Dental Associations, Harvard Dental Alumni Association, Harvard Odontological, American Society of Orthodontists, etc. As a teacher he was a student with students, always courteous and ever willing to impart what he could of his unlimited knowledge of his favorite subject. And the student who could be in Doctor Reoch's class considered himself fortunate. He had a happy home and a loving wife (formerly Miss Helen Baker) whom he married October 6, 1915. He loved animals as he loved children; he loved nature, the woods, the hills, the streams, and he loved the ocean—and the ocean caused his death.

He was buried from his father's home in Phenix, Rhode Island, on May 29th. He left behind him his family, his little patients, and a host of friends to mourn: but the world is a better world because Norman Reoch lived.

IS FACIAL DEVELOPMENT AN INDEX TO CHARACTER?

By Edward L. Mitchell, D.D.S., Indianapolis, Ind.

FOR ages past the human family have labored under a fallacy that heredity was responsible for almost everything in man, from the minutest physical development to that of his intellect, mind and soul. The phrenologist has pictured life from the developmental bumps. The physiognomist portrays a man's character and life from the face, blaming nature for certain conditions, and depicting in it all his strength and weaknesses, painting a prophetic portrait of his real life and possibilities, but always forgetting that we are human and bend to suit certain conditions of environment almost as soon as we are born into the world. The man with a square, prominent chin has been credited with an undue amount of determination, while a lack of development of the same has been significant of natural weakness.

Why have these ideas predominated with never a thought as to why each developed in such proportions? We know that these conditions have no place in the normal, natural man; then how could they be of such significance? Early correct the conditions that stimulated an abnormal development of that chin, and in each case we may have a normal, beautifully proportioned face. How little people realize that their natural, beautiful development is interrupted, and how willing they are to accept the idea that they only resemble their ancestry. Wonder what the physiognomist, the artist, the creator of modern literature will do when the world caters to its possibilities by early having these abnormalities corrected and developing physically and otherwise along normal lines.

We must grant that these physical defects do many times leave their imprint upon character and personality, but shall we not be cognizant as to why such things are true? When nature breathes us into the world for the first time, we are what we are from natural causes, and if there has been no congenital disturbance, are normal living creatures. From this time forward we are subjects of environment and physically and otherwise succumb to its influences.

It has been proven by contact with science that the primary cause of our existence and the paramount factor in our subsequent development is mechanical stimulation. The lion that must seek his prey in his native jungle develops along an entirely different line and in different proportions from the one reared in captivity. Just so, the skeleton of a man may depict his real life.

If mechanical stimulation is the cause of our development, what produces the stimuli and how may these forces be deflected and produce the abnormal? In answering the above let us consider these influences under two heads.

First, direct, or those forces which directly affect tissue development. Second, indirect, or those which, through systemic conditions and lack of nutrition, together with the psychic state, affect not only the physical development, but that of intellect and personality.

Under direct, let us consider the eruptive force of the teeth, interdependence of the two jaws, together with the forces of occlusion. As stated in a

former discussion, a child is born without teeth, at which time all the germs that develop the temporary teeth and six-year molars are in their crypts, suspended from the occlusal corticle plate. Crowns begin to grow, then roots, exerting a pressure upon crypt and occlusal plate, the crypt being forced back through cancellous bone. As these tooth cells multiply, stimulus is transmitted to the bone and the jaws begin to grow in three directions—forward, outward, and downward in the upper; and forward, outward, and upward in the lower. At six to eight months the bone has been absorbed over central incisors and they erupt, lowers first, then uppers; laterals a few weeks or months later, and so on at intervals until, by the time the child is two and one-half to three years of age, it has twenty teeth and there is room for no more. However, three more molars are to erupt posterior to the temporary teeth. The first permanent molars then begin their force of eruption, acting as a jack-screw, force being transmitted forward through the temporary teeth until at six years all have been carried forward with process a sufficient distance, and the first permanent molars take their places in the arch.

During this period the permanent incisors are developing lingually and deeper into tissue from the temporary teeth. Through their growth distance has been increased from floor of nose to alveolar border in maxillæ, and from lower corticle plate to alveolar border in mandible. Dr. Cryer says: "Up to this age greater amount of growth has taken place from mental foramen to symphysis in mandible, subsequent growth being greatest from mental foramen to angle of jaw, account stimulus transmitted from bicuspids and second and third molars in their force of eruption."

During this entire period the jaws continue to grow through three dimensions of space, and if jaws and teeth are performing their function, the child is breathing normally and all other forces of occlusion are normal, second and third molars will take their positions alike, exerting their greatest developmental influence until the nasal passages, dental apparatus, and entire face have developed in normal, beautiful proportions. If, however, some of these forces fail and a certain amount of normal activity of developmental cells is lost, we may have impaction of third molars or other irregularities, just in proportion to the abnormal influence of the forces of occlusion.

While the teeth are thus contributing their stimuli toward facial development, the other forces of occlusion each are playing their part and have their function to perform, if normal development is attained; muscular pressure and activity being among these influences. As has been recently mentioned by others, a child swallows once every one or two minutes. The action of the lips, tongue and muscles of deglutition in this capacity is important and cannot be ignored. The lips are moistened and closed, teeth brought in contact with each other, tongue pushed forward against the palate, the tensor palati muscle becomes active, bringing soft palate and tongue rigidly in contact with each other, obliterating any space in oral cavity; the child swallows, at which time there is an interchange of air in the middle ear through the eustachian tube.

In the act of swallowing the lips are stimulated to their normal growth, the tongue being brought rigidly in contact with palate, stimulating lateral growth of the maxillæ. A vacuum is created by tongue and palate, and a suc-

tion when tongue is released, which, together with air pressure, etc., in the act of nasal respiration, stimulates downward growth of palate processes and palate bones, hence development of nasal space. The teeth in occlusion at this time, together with action of muscles of mastication and all other forces mentioned, are conducive to symmetrical relations of the teeth and facial development according to the typal requirements of the individual.

Thus, you see, if the ideal facial development is ever attained, the teeth must harmonize with some ideal line. This has been designated as "the line of occlusion," not having reference to alignment of teeth in each individual jaw, but, quoting from Dr. Angle, means much more.

"It is that line with which, in form and position according to type, the teeth must be in harmony when in normal occlusion. There can be but one true line of occlusion, and it must be the same as the architectural line on which the dental apparatus is constructed. This ideal line was intended to govern not only the length, breadth and peculiar curve of the dental arches, but the size and pattern of each individual tooth, cusp and incline plane composing these arches.

"It must have been intended that the line of occlusion should be in harmony in form and position with and in proper relation to all other parts of the great structure, according to the inherited type of the individual."

Then we must see that just in proportion as the teeth in arrangement are in harmony with the "line of occlusion," so is the harmony and balance of the face affected, and to the extent we are able to conceive that the line of occlusion is the "basic ideal of the dental apparatus" and conform our activities to such, shall be our conception of what real orthodontia means and our successes or failures in it.

We have considered the effect of normal breathing on facial development with the force exerted by the act of swallowing. But suppose on account of some violation of the laws of nature, from hypertrophied pharyngeal tonsil or other nasal obstruction the child becomes a mouth breather, mouth being open, muscles that control the lips are relaxed and inactive; the upper lip, failing to receive its normal stimulus, stops growing; depressors of mandible are active, tongue drops back in the throat and not only fails to exert its normal stimulus in the act of swallowing, but partially obstructs the passageway to the lungs even through the mouth; the ears fail to receive an interchange of air; pressure being greater externally than internally, membrana tympanæ become deflected inward and finally thickened. As a result the child is hard of hearing.

Thus you may readily see that from lack of development the upper lip fails to perform its function, the maxillæ lose their lateral stimulus from the tongue, it being far back of its normal position. During this time the teeth continue to exert their developmental force, then as a natural consequence, there being nothing to interfere with forward development and nothing to stimulate later growth of maxillæ, a narrow V-shaped arch with high vault is the inevitable result. The arch is narrow, not because it has been contracted to any great extent, but because it failed to develop. The depressors of the mandibles have retarded its development, the lower six-year molars lock distal to normal, and

the whole scheme of the dental apparatus applies its stimulus to produce deformity.

Another child, though perhaps more fortunate as regards nasal respiration, has an attack of tonsillitis; the faucial tonsil becomes inflamed and hypertrophied, exerting pressure upon the muscles that form the pillars of the pharynx. In an effort to relieve this pressure the child pushes the lower jaw forward and the lower first molar locks mesal to normal. Again harmony and balance have been destroyed and asymmetry is the certain goal.

There are many other influences that affect physical development, such as habit, premature loss of teeth, bad dentistry, etc. However, a mere mention of them must suffice at this time, that we may pass to another phase of this subject.

In considering the indirect cause of physical development, together with that of mentality, let us first know the function of the nose. It is not strictly the organ of smell, but has a function that is four-fold, i. e., respiratory, phonatory, olfactory and gustatory. In addition to this it affects the auditory sense by equalization of pressure.

Under respiratory let us consider the function of the turbinates with their covering epithelium. This membrane is plenteously supplied with minute cells, the function of which is to secrete moisture; some authors have estimated this supply to be as much as three pints in a normal adult in twenty-four hours. In passing through the nose the air is freed of its impurities in two ways, i. e., by precipitation and by the antiseptic action of these secretions. In addition to this, it supplies the air with the proper amount of moisture, and by its thermal action reduces air, whether warm or cool, to about body temperature.

We readily see, then, how necessary to real life and health is nasal respiration, and why mouth-breathers cannot in any respect be normal. They lose that pint and quart of moisture, the antiseptic and purifying action and the thermal effect of the nasal space, allowing the air to pass into the lungs in a condition that not only incapacitates it as regards the purification of the blood, but in a condition that is almost incompatible with life itself. The tissues fail to receive their nourishment, leaving the brain and nervous system, as well as all of the organs and tissues, far below normal. Is it any wonder then that a weakness accompanies lack of development of the chin, or a so-called weak face, and the importance of the preservation of all in a developing child, and that mere family traits or depiction of character?

The psychic effect upon the child we have not mentioned, but it must not be forgotten. Many a child already handicapped by abnormal respiration and defective hearing, by a mere accident at six years of age, may start developing a face to belie its real character and personality. Nutrition is faulty, hearing defective, which renders it unable to grasp many things in the school-room. It becomes sensitive as regards its condition, delinquent in its classes, loses interest, together with the possibilities of living its real life, all because some one failed to appreciate the science of function.

The dental profession is in a position to recognize these prospectives before anyone else. Then let us study these deplorable conditions. We cannot all be orthodontists, but are we not, as a profession, duty bound to know enough about normal occlusion, the line of occlusion, and the laws of develop-

ment that we may at least intelligently advise those with whom we come in contact? Remember in each case the value of the wedging force of the teeth and the importance of the preservation of all in a developing child, and that extraction to correct an irregularity only leaves the same lack of development; and in Class II case where we have a narrow arch, a lack of development of nasal passages really lessens the size of the nasal space and increases the impossibility of the child ever breathing normally.

Remember the relation of the first molar, and never advise anyone to stand idly by and allow a child to develop a deformity, laboring under the pernicious idea that all of the permanent teeth must have erupted before any changes be made. Or again, that there is a possibility that the child and his jaws will continue to grow until the teeth finally have room to take their normal position. How absurd this is when we know that the wedging force of the teeth is largely responsible for facial development, and that if contact is broken and a tooth pushed out of line, the same forces that cause it to occupy that position will only tend to push it farther.

Remember that future development may be largely foretold at six years of age, and that to the extent the teeth harmonize with the line of occlusion, to that extent the harmony and balance of the face and development of the nasal passages are affected; to that extent also we are able to masticate our food and breathe properly, and to that extent our nutrition, general development, personality and life are affected. Remember that the face in its entire development may be the index to personality, and that if we appreciate these things in their fullest value the physical and mental development of the world may be revolutionized.

For the fundamental thoughts of this paper I am indebted to Dr. Edward H. Angle, Dr. F. B. Noyes, Dr. Lawrence G. Singleton, and others.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID McCOY, D.D.S., EDITOR
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PREVENTION OF MALOCCLUSION

X-ray Measurement of the Unerupted Permanent Teeth at the Age of Five or Six Years to Provide for Regulation of the Temporary Arch if Required.

BY SINCLAIR TOUSEY, A.M., M.D., NEW YORK CITY.

AT a meeting of the New York Institute of Stomatology in 1906, I showed a large number of radiographs of the unerupted permanent teeth of a great number of children, aged 5 or 6 years, taken in such a way as to show the actual width of the unerupted permanent upper and lower central incisor teeth. The idea was to furnish the orthodontist measurements of these teeth in hundredths of an inch and also a life-size diagram of the correct permanent arch calculated from a modification of Hawley's method; compared with the actual temporary curve obtained by biting a sheet of wax. The orthodontist was advised to correct the temporary arch if its radius of curvature did not equal that of the arch calculated either by my method or his own for permanent upper centrals of the width shown by the radiograph. In addition, measurements were recorded of the temporary teeth.

After five to eight years, as many as possible of these children were traced. They were purposely poor children who would not be likely to be taken to the orthodontist for correction. In seven of these original cases, I was able to trace and show at a meeting of the Eastern Graduates of the Angle School of

Fig. 1.

Fig. 2.

Figs. 1 and 2.—Radiographs of the permanent teeth before eruption. The width may be determined within 1/100 inch.

Orthodontia, the recorded x-ray measurements of the upper and lower central incisors were correct within 1/100 inch. The width of the permanent upper and lower centrals bore no relation whatsoever to that of the same teeth of the temporary set. The broadest permanent teeth sometimes occurred with the narrowest temporary teeth. In every case the radius of curvature in the permanent arch was the same as that in the temporary arch whether that was right or wrong

Fig. 3-A.

Fig. 3-B.

Fig. 3.—Temporary teeth arranged in curve corresponding to permanent upper central incisors 0.30 inch wide, while the x-ray shows the latter are 0.35 inch wide. Comparison between the existent curve and what the temporary curve should be regulated to.

for the permanent teeth. In cases with a temporary curve the correct size for the permanent teeth, the latter erupted promptly and in a uniform curve; but in the cases where the temporary curve was too small for the permanent teeth, absolutely no spontaneous expansion took place, and the varied permanent teeth were delayed in eruption and irregular in position.

After time had proven the correctness of my x-ray measurements, the non-relation in size between the temporary and permanent teeth and the reproduction of temporary arch without spontaneous correction in the permanent arch, I began to recommend x-ray measurement as a means of the prevention of malocclusion.

This is the best place to state that I do not regard the orthodontist as a "beauty doctor" but as the man whose duty it is to see that the child grows up with a healthily placed set of teeth and healthily formed nasal passages and healthily formed accessory pneumatic sinuses. The orthodontist knows better than anyone else in the community that without the correct size and position of the various parts enumerated, a formidable list of evils ensue. There is malocclusion with imperfect contact between the upper and lower teeth, more or less imperfect mastication and digestion and nutrition. Malocclusion with various teeth subjected to unnatural stress is a direct and frequent cause of pyorrhea.

Fig. 4.—X-ray warning disregarded, no spontaneous expansion, non-eruption of one permanent upper lateral incisor; nasal operations have been required.

The arrested development or the misplacement of the permanent teeth leads to arrested development of the maxillæ and the nasal passages. The worst effects are produced when the dental arch is so narrow as to force the hard palate up into a high vault above which the nasal septum is crumpled up into spurs and deviations. The resulting obstructing of the nasal passages leads to adenoids and hypertrophied tonsils whose removal does not cure the mouth breathing. In fact, with such a start, life is one long series of throat and nose troubles and operations.

The ease with which the temporary arch can be regulated to the proper curvature is equalled by the ease with which at this formative period deviations of the nasal septum are corrected by expansion of the dental arch. The general physician knows that insufficient nasal passages predispose to tuberculosis and are directly opposed to longevity.

Many a case has come to me to determine the presence or absence of an unerupted tooth and I have had numerous opportunities to verify the fact that

in this condition the dental arch is too narrow for the width of the permanent teeth. I am fully convinced that there exists a causative relation.

Putting my discovery into actual practice, I have found that it is necessary to obtain a radiograph which shall show one of the upper central incisors directly facing the source of x-rays and not partially in profile. The first two radiographs locate the unerupted permanent tooth and a final radiograph is then

Fig. 5.

obtained from which an accurate measurement of the width of the tooth in question may be made. The crown of the unerupted upper central is fully developed at the age of 5½ years and has been shown over and over again to have exactly the same width that it has seven to ten years later. The orthodontist is given this measurement and also a life size drawing of the proper curve as compared with the actual temporary curve. This does not, however, mean that all jaws with upper central incisors of the same width shall be regulated to an identical curve. The orthodontist will take the nationality of the child and the type of face into account in deciding the form to be given to the arch, and use the measurement of the unerupted upper central as a guide to the radius or the size of arch required.

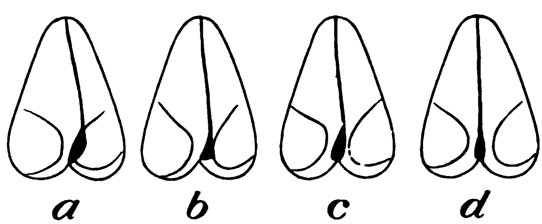

Fig. 5.—Deviations of the nasal septum in a young child straightened in a few weeks by regulation of the teeth. (Dental treatment by Dr. E. A. Bogue; nasal examination and diagrams by Doctor Berens.)

One example from actual practice is the daughter of a nose and throat specialist. She had a beautiful regular temporary arch of a radius corresponding to permanent upper centrals 0.30 inch wide. The radiograph showed permanent upper central incisors of a width of 0.35 inch and the fact that the temporary arch required corresponding expansion was pointed out. The orthodontist, however, expressed doubt as to the correctness of the x-ray measurement and the temporary arch was not enlarged. Later when the permanent upper centrals erupted they were found to be exactly of the width predicted by the x-ray and of course came in crowded and rotated; and the eruption

of one of the upper lateral incisors was delayed. Meanwhile the little girl was undergoing nose and throat troubles and operations. Later suitable regulation was done and a few weeks ago the father reported a splendid condition.

In another case, the x-ray measurement was implicitly relied upon and regulation of the temporary arch was performed. The permanent teeth erupted in excellent position and at an earlier date than the average and were of the width predicted. The child had been through operations for adenoids and tonsils before the x-ray examination was made and had been a small delicate girl with a sharp face. Now she is of the most robust appearance and wears clothes one or two sizes larger than girls of her age, and has normal occlusion.

Roentgenography and Dental Pathology.*

THE author emphasizes that properly made and correctly interpreted rœntgenograms of the teeth are of inestimable value in making diagnoses. It does not do to accept a rœntgenogram unless it is absolutely clear and shows the parts in every detail. On the other hand, even the clearest rœntgenogram is often misinterpreted.

On February 1, 1916, Dr. Brophy, before the Odontological Society of Chicago, spoke as follows:

"I have lately been impressed with the condition known as darkened area in rœntgen photographs not only from the work that I have had done, but on account of reviewing the work of others. It was not until probably four years ago that I was impressed with the mistakes I had made in reading x-ray pictures, and that was brought about in this way (I point this out because I am satisfied that a great many have made and perhaps are making the same mistakes that I did): At that time whenever I saw a darkened area around the apex of a root of a tooth I assumed that it meant the presence of an abscess, but when I made x-ray pictures of fracture of the mandible I found a well-defined line of fracture, for which I made use of splints, readjusted the fragments, restored the normal occlusion of the teeth, waited six or eight weeks, and then made another skiagraph of the same bone at the same place; I found exactly the same appearance that I found when I had the first skiagraph made, and concluded, before I learned better, that a fracture still existed. The newly formed bone was not sufficiently dense in structure, not sufficiently ossified to present the same appearance that the normal older bone did, so I was misled. Leaving the splints on for five or six weeks longer and again making a rœntgen photograph, I still found a well-defined line at the fracture; but feeling satisfied that the bone was united, I removed the splints and found that the bone had firmly united and was all right, yet at that time it showed exactly the same condition that it did when the first skiagraph was made. This led me to believe that I had been making mistakes regarding the darkened areas at the ends of the roots of teeth.

"Now I am convinced that these darkened areas we see on the plate are by no means evidence of an abscess. They are evidence, however, that an abscess

*Abstract from paper by Truman W. Brophy in Medical Clinics of Chicago, July, 1916; Reprinted from American Journal of Rœntgenology, October, 1916.

once existed, that the bone was destroyed or absorbed by pressure, and that perhaps there was infection of the organic matter of the bone to such an extent that some of the bone itself became disintegrated. In some instances we all know a great deal of the bone will become disintegrated and large cavities will be left at the ends of the roots of the teeth; but these large cavities, everything being done to exclude further infection by having the root well defined, will be filled by the new bone.

"In this connection I would like to state that at the meeting of the Clinical Congress of Surgeons of North America, held in Boston last fall, Dr. M. L. Rhein read a paper on this subject and presented by means of the stereopticon, some plates showing teeth, the roots of which were not well filled, with rather large areas of destruction at their apices. Then he showed the same teeth, skiagraphs of which were made two years later. He had removed the fillings from the roots of those teeth and refilled them, following which there was sclerosis, the bone was well developed, completely surrounding the end of the roots, and showing as complete an alveolus as surrounded any of the teeth with living pulps. The darkened cavities were filled with new bone."

Terminology.*

MUCH confusion could be avoided if all who write and speak concerning rœntgen ray work would adopt a uniform terminology. Skiagraph, skiagram, radiograph, radiogram, rœntgenograph, rœntgenogram, and x-ray picture are only a few of the terms which are used in manuscripts arriving at the editor's desk. It is highly desirable that rœntgenologists should devote special effort to the adoption of the standard terminology both in their writings and in their daily speech. Rœntgen called his discovery the "x-ray," but the civilized world has seen fit to designate this wonderful ray by a special name in honor of the discoverer, and the name Rœntgen has entered into the literature of all countries, including our own. Since the beginning of the great War the term Rœntgen has become distasteful in certain quarters and an effort is being made to revert to the older terminology. Our greatest American medical periodicals, such as the *Journal of the American Medical Association, Surgery, Gynecology and Obstetrics,* and the *Annals of Surgery,* have adopted the terminology which was given full approval by the American Rœntgen Ray Society at its annual session in Boston, in 1914. Appended will be found a list of the more important words relating to our specialty, which our members are urged to use, not only in writing, but in their daily speech.

The employment of the phrase "x-ray picture" is only more or less natural for the layman, but it should not be for the physician, especially one who practices rœntgenology. Rœntgenograms are not pictures in the ordinary sense of the word, and rœntgenology in its most valuable application to internal medicine is not a matter of rœntgenograms or so-called "x-ray pictures." Hence the employment of the term "x-ray picture" only serves to perpetuate an erroneous idea. While technical knowledge and practical experience are

*Reprinted from American Journal of Rœntgenology, October, 1916 (editorial).

required for mechanically perfect rœntgen ray work, the real work of the physician who specializes in rœntgenology does not begin until the image has been secured, and his work is therefore not in any but a small sense a photographic labor. It would be helpful if all physicians would discourage the use of this and allied crude terms, and adopt the standard terminology which has the unanimous approval of our national rœntgen society and the editors of our prominent medical periodicals. Some of the more important words relating especially to rœntgen work are included in the following list:

Rœntgen—pronounced rent gen.

Rœntgen ray—a phenomenon in physics discovered by William Conrad Rœntgen.

Rœntgenology—the study and practice of the rœntgen ray as it applies to medicine and surgery.

Rœntgenologist—one skilled in rœntgenology.

Rœntgenogram—the shadow picture produced by the rœntgen ray on a sensitized plate or film.

Rœntgenograph—(verb) to make a rœntgenogram.

Rœntgenoscope—an apparatus for examination with the fluoroscopic screen excited by the rœntgen ray.

Rœntgenoscopy—examination by means of the rœntgenoscope.

Rœntgenography—the art of making rœntgenograms.

Rœntgenize—to apply the rœntgen ray.

Rœntgenization—the application of the rœntgen ray.

Rœntgenism—untoward effect of the rœntgen ray.

Rœntgen Diagnosis—diagnosis by the aid of the rœntgen ray.

Rœntgenotherapy—treatment by the application of the rœntgen ray.

Rœntgen Dermatitis—skin reaction due to too strong or too oft repeated application of the rœntgen ray.

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EDITORIALS

Dental Societies and the Ownership of Papers Presented Before Them

A LARGE number of dental societies have published upon their programs, or somewhere in their constitutions, the fact that papers which are presented before their members shall become the property of the society. It is conceded that when a man gives a paper before a society at its invitation, the paper belongs to the society to use as it desires. In other words, if the society decides to have the paper published in a certain journal, the man who gave the paper has nothing to say in regard to it, because, after he has given it to the society, it is not his property, but the property of the society. However, we have known of several instances where men who have given papers before a society have withheld them from publication by the society, and have published them themselves in such dental journals as they have seen fit. This is an extremely unfortunate thing, and certainly is very discourteous. However, this very thing has recently been done by a very prominent man in the profession, who, having read a paper before a dental society which is publishing its own

dental journal for the purpose of elevating the science of dentistry, stated that, owing to the fact that the journal published by the society had such a small circulation, he would withhold his paper from publication therein, and publish it in one of the large trade journals, so that it would have a large circulation. It certainly was very discourteous; a very unprofessional thing for him to do; and a great insult to the dental society that invited him to read the paper. However,. it has become the habit with a number of men to believe, whenever they consent to read a paper before a dental society, that they are honoring that particular society; while, as a matter of fact, we have always thought it a great honor for a man to be invited to read a paper before a dental society.

We do not believe that any one individual is as big as the dental profession as a whole; and, therefore, when a man assumes an attitude that he has the right to publish his paper where he pleases, regardless of what the society believes, it is time that something be done to make him realize that he is only one among the dental profession.

Dental Caries in Childhood

MODERN medicine is concerned with the prevention of disease and nowhere is there a wider field for the exercise of this function than during childhood. A preventive measure of prime importance is the care of the teeth. Unfortunately many dentists do not realize the importance of caring for children's teeth. They argue that it is not worth while caring for the deciduous teeth, and in reply to the statement that neglect of the deciduous teeth may result in permanent deformity they reply that the permanent teeth may be deformed anyway. Ignorance is the greatest obstacle in the way of securing proper dental care. Dental deformities frequently mean much more than merely deformities of the teeth. They may be responsible for deformities of the face and jaw, and they may be a factor in the production of adenoids, nasal hypertrophy, and tonsillar enlargements. The selection of a proper dietary has an important bearing on the development of the teeth. Malocclusion interferes with proper mastication and is therefore the starting point of many nutritional disorders. The digestion of starches cannot be normal if mastication is imperfect. Infections of the teeth cause dental caries and pyorrhea. The chemicobacterial theory is now generally accepted as explaining the causation of caries. On this theory caries is attributed to a fermentative process. Particles of carbohydrate food become lodged in the crevices of the teeth, fermentation takes place, and the acid products of the fermentation attack the enamel of the teeth. Hence the soft, sweet, sticky foods of which children are so fond may be regarded as a cause of dental caries. It has been found that pyorrhea alveolar almost always causes other infections. There is a definite relationship between pyorrhea and the various focal infections with which we are all familiar. The first step toward the relief of the present situation is to make the medical profession realize the significance of dental hygiene. Their interest must be stimulated so that they will undertake to awake a general interest in this subject in their own communities. The dentist must come to realize that he is not merely an

artisan and a mechanic, but that he is working in a definite field of medicine and that the care of the teeth of children is of sufficient importance to merit his most careful consideration. Parents must be made to realize the importance of proper development and care of the teeth in children and must be taught that such care is worth paying for. Proper provision should be made for the care of the teeth of children whose parents are unable to pay for this service. Every clinic for children should recognize that a dental department is an inherent part of its organization.

The President's Address Before the Fifteenth Annual Meeting of the American Society of Orthodontists

AT the fifteenth annual meeting of the American Society of Orthodontists, held in Pittsburgh, July 20th, 1916. Dr. E. C. Kemple delivered the following address (*Items of Interest,* October, 1916):

"It affords me a thrill of genuine pleasure to again greet the members and guests of this Society. With most of you it is like meeting old and close personal friends whose interests and aims are common with my own, and the grasp of whose hands stirs pleasant memories of our early meetings. I feel that this Society is much like one big family whose individual members are all laboring for a common purpose and all pulling together toward a common goal.

"It is a matter of personal regret however to many of us that we have just permitted an interval of more than two years to elapse during which time we have had no regular meeting. The value to us, as orthodontists, of these regular annual interchanges of ideas, and the opportunities they offer for a general and generous discussion of the many problems that constantly confront us in daily practice can not be even approximately estimated. They are as essential to the development and growth of orthodontia as wholesome food and drink are to the human body. It must therefore be recognized now as a serious mistake for our members to allow the schedule of any other convention to interfere with the regular annual sessions of this organization.

"I am constrained also on this occasion to congratulate this American Society of Orthodontists on its substantial stability as a progressive professional body, and on the steadiness and consistency with which it has pursued the even tenor of its purpose, without regard to or consideration of the determined and persistent efforts that are continually being made to wreck it. At the time of this fifteenth annual meeting our membership is larger than ever before in the history of the society, and I believe you will all agree, at the close of this session, that the program prepared by our Board of Censors for this occasion will compare favorably with any similar program to which it has been your privilege to listen.

"The candor and earnestness with which decided differences of opinion are here discussed are also matters for congratulation. 'When men smile and agree, Progress weeps,' is the assertion of an eminent surgeon in one of his

recent works. But when men disagree as decidedly as they do in this society, and still smile there is every reason why Progress should applaud.

"And this leads to the thought that progress—real progress—is seldom made by leaps and bounds, but almost invariably by a steady imperceptible advance, like the movement of the hands of a clock, or the growth of an oak. In medicine and dentistry—including of course the specialty of orthodontia—there must ever occur those occasional spasms caused by the announcement of some new idea that is hailed by enthusiasts as revolutionary to established methods. These predicted revolutions in our methods of practice usually result in nothing more than a nine days' disturbance of ideas. They occupy our attention for a very short time and quietly die, leaving as a heritage to the profession only a memory of another experiment that failed. And progress continues in her snail pace fashion.

"New ideas of practice have always received a cordial welcome at the hands of the members of this society; they have ever shown a willingness to test the clinical value of every idea advanced by trying it out in their individual practices, observing and noting its worth, and publishing their opinions broadcast to the dental profession. Our members have no mysteries to be hidden, no secrets to conceal concerning their modes of work. Every dentist and every physician who is interested in any manner in orthodontia is always cordially invited to attend all our meetings and to take part in the discussions. The purpose of this society is to educate its members along the broadest possible lines—for the advancement of the knowledge of orthodontia not alone among ourselves but among the dental profession at large.

"The deeper we go into the study and practice of orthodontia the more perplexing are many of the problems that confront us, the more insurmountable seem many of the difficulties that loom in our paths, the more ideals are shattered and the more failures there seem to be to stare us in the face.

"A few of our problems are being gradually solved, but in this, as in every other science, with each advance step that is made the field for study and research becomes immeasurably increased. The past decade can confidently be counted as years of remarkable progress in orthodontia, and yet an analysis of the literature covering this period will probably leave us with the conviction that we have scarcely scratched the surface of the subject of our study. One point of real advantage that has been reached through the past fifteen years of study is a complete realization of our profound ignorance of many of the questions upon which, fifteen years ago, we felt we were fully informed. Let us hope then that this is the beginning of wisdom.

"One of the weak points in the fabric of orthodontia to-day is the scarcity and incompleteness of our records of both treated and untreated cases. And I am more than pleased to have on the program of this meeting a paper by one of our veteran members on the subject, "The Records of an Orthodontist." To my mind this is one of the most important subjects with which we have to deal, because of the fact that in the final analysis these records must form the very foundation of our knowledge of malocclusion. One of the questions frequently asked by a parent who is considering the advisability of having orthodontic treatment for his child is: "What is going to happen if this work is not

done, if the teeth are left just as they are?" In the large proportion of cases that are presented for treatment, how many of us can answer that question intelligently and with any degree of assurance?

"To answer such questions intelligently requires a careful and thorough study of the complete records of a large number of untreated cases, and at the present time there are very, very few such records to be had, and while I recognize the difficulty of obtaining complete records of untreated cases, nevertheless I earnestly urge our members to secure as many of these as possible. We must have them if we hope to learn what is likely to happen in cases that are left untreated. And we must know what is likely to happen in cases that are left untreated if we hope to advise our patients intelligently.

"There is small doubt in my mind but that a careful study of even fifty or one hundred sets of models of untreated cases, the first taken, say, at the age of from five to seven years, and the last at from twelve to fourteen years of age, would greatly modify the present practice of early treatment.

"Another point that should be thoroughly studied and the observations carefully recorded and published by the members of this Society is the change that takes place in the glenoid fossa as indicated by the path of the condyle in both treated and untreated cases of malocclusion. We are probably all confirmed in the opinion that a very marked change takes place in this region in most of our cases during the period of treatment, but with our present knowledge, or rather our lack of knowledge, we can only blindly guess or surmise what this possible change may be.

"A collection of carefully made tracings of the path of the condyle, at the beginning, and at intervals during the course of treatment, and again a final tracing a year or two after the completion of treatment, might throw considerable light on what is now rather a dark subject.

"Dr. Milton T. Watson records the incident of one of his little patients, who was being treated for a Class 3 malocclusion, jumping out of bed at night and running to her mother with the joyful announcement that 'her jaw had just gone back.' It would be not only interesting, but instructive, if we could know just what took place when this jaw 'went back.'

In many Class II cases excessively deep overbites in the incisal regions have apparently corrected themselves during the shifting of the mesio-distal relation of the molars and bicuspids without any effort whatever on the part of the operator to control the overbite. In these cases also it would be instructive to know what change has taken place in the region of the glenoid fossa.

"I would suggest therefore that our members equip themselves with the means of studying the condyle path and that they make these tracings a part of the records of their cases.

"Almost since the beginning of orthodontia it has been a customary practice of all operators to place metallic bands on young teeth that are just erupting and to leave these bands cemented to the teeth for a period of one, two or even three years, with apparently no thought of the possible effect they have on the physiological and histological processes going on within the structure of the teeth so banded. It is rather unreasonable to believe that a young growing tooth can be incased in such an artificial covering for so prolonged a period

without there being produced some physiological disturbance within the body of the tooth which may considerably alter its histological structure.

"To find the answer to this question also offers an interesting bit of research for those of our members who are scientifically inclined.

"Through the efforts of a number of the members of this Society, and the co-operation of several metallurgists, the question of the best material to be used in the construction of orthodontic appliances has been fairly satisfactorily answered. This, together with the fact that this Society never occupied so strong a position in its history as it does at the present time, inspires me to recommend that committees be appointed to assist in the study of such questions as the changes in the region of the glenoid fossa, and also on the possible effects that cemented bands may produce on the internal structure of the tooth and many others of a similar nature.

"I am earnestly interested in seeing this Society devote its energies to such lines of research as may lead to tangible, practical solutions of the problems being investigated and that may culminate in the form of positive knowledge.

"I cannot close this address without expressing to the members of this Society my sincere appreciation of the honor they have conferred upon me by choosing me as their presiding officer for this session, and to acknowledge my grateful thanks to the Board of Censors for the splendid program which they have prepared for this meeting, and to the Secretary-Treasurer and the Vice-President for their willing co-operation in making this meeting a success."

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ORIGINAL ARTICLES

THE ROLE OF MOUTH INFECTIONS AND MOUTH ABNORMALITIES IN THE CAUSATION OF DISEASE*

BY EUGENE LYMAN FISK, M.D.

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THERE is no more important field of preventive medicine than that of the hygiene of the head. The more one studies the modern man—civilized, cultured, pampered, served by scientifically harnessed natural forces almost as was Aladdin by the slaves of the lamp—the more evident it becomes that disease, old age, and death fairly radiate from the cavities of the head.

Take, for example, the repeated acute infections having their origin in obstructed nasal passages lined with unhealthy mucous membranes poorly equipped to meet infection. Season after season the mass of the population suffer from these nasopharyngeal affections involving acute bacterial attack and resultant strain of organic tissue. In some cases death occurs from acute pneumonia, mastoiditis, brain abscess; in others chronic pulmonary disease or tuberculosis. Setting aside the effects of repeated frank, acute nasopharyngeal affections, rhinitis, grippe, tonsillitis, regarded as more or less normal experiences of the average individual, and also eliminating pneumonia and tuberculosis, we have to consider the effects of the establishment in the various cavities of chronic foci of infection. These cavities, tooth-sockets, accessory sinuses, tonsillar crypts, middle ear, etc., are, as Rosenau and others have shown, veritable culture tubes, where the streptococci and pneumococci go into training, as it were, before streaming out to attack those portions of the body where they can best thrive. Thus it is no mere figure of speech to say that in the head are the training camps for the most dangerous enemies of the human race. These microorganisms are among the chief causes of chronic disease and therefore of old age and death. As Mayo has expressed it, "Life is one long struggle with microorganisms."

*Read before the Eastern Association of Graduates of the Angle School of Orthodontia, May 5, 1916.

Deficiency diseases we undoubtedly have, like beriberi, scurvy, and probably pellagra, but I am firmly convinced that long before such stages of serious tissue impairment due to deficiency of vitamins or other necessary elements are reached, there are various degrees of deprivation that lessen the resistance of bacterial attack, substandard conditions of the body that pass unnoticed and unnamed until some organ obviously fails in its task, and then we call it disease.

Eliminating the so-called communicable diseases, such as typhoid and tuberculosis, we still have a tremendous death-rate from disease that is essentially due to infection. Chronic cardiorenal-vascular diseases are responsible for more than twenty-five per cent of the total death-rate. We know now that in all these organic affections, bacteria play a prominent and often the principal part. Injury, strains, poisons, endogenous or exogenous, all have their influence, but bacterial attack must be recognized at some stage of the game. I believe I am safe in saying that if the cavities in the head could be kept in a thoroughly healthy state, free from infection and their functions well maintained, at least four years could be added to the expectation of human life. This sounds like a little bit, but it means a tremendous reduction in the death-rate.

I would not minimize the role of the intestine as a great focus of subinfection, and of miscalled auto-intoxication. But it is not as guilty as formerly supposed. Indeed, in much of the damage that it does, it is merely an accomplice after the fact of focal head infection that has travelled downward.

The freedom with which bacteria range throughout the human organism has only lately been recognized. Subinfection, radiating from focal infection, must be recognized as one of the principal factors in organic impairment. Even in tuberculosis we find that the process of infection is not so simple as formerly supposed. The fact that tubercle bacilli can traverse the stomach and intestinal canal, penetrate the walls of the intestine without leaving any trace, and finally reach the bronchial glands or lungs, is an illustration of the losing fight that mankind is maintaining with the various forms of bacteria.

Since death comes to all ultimately, always in the form of a pathological state, I am justified in terming this a losing fight. What I have said regarding the hygiene of the head and the importance of the head cavities as potential factors in organic disease, emphasizes the tremendous responsibility upon those who are specializing in that region. It is the region par excellence for the entry of infection, as well as for nutritive material and oxygen.

It would be difficult to find an individual with absolutely normal and perfectly functionating head cavities. In using this expression, I am of course excluding the brain. Harry Campbell has recently stated that there are upwards of two hundred millions of carious teeth in the British Isles, and even a greater number of infected tooth sockets, while as to jaws, it is rare to meet a normal one. There is no reason to believe that these conditions are any better in this country. False teeth, long teeth, irregular teeth, infected gums, asymmetric jaws, are the rule rather than the exception. The field, therefore, is an almost limitless one, and the chief responsibility upon the specialist, as upon all others who are working in modern medicine, is to begin as early as possible in the life of the individual to detect abnormalities of these cavities, correct them, and protect the individual from future impairment.

The protection of the deciduous teeth falls to the parent and the dentist, as a part of mouth hygiene. While success in this direction will limit the need for the orthodontist, there will always be plenty for him to do in correcting those forms of irregularity and asymmetry due to heredity or other causes. Also, on the one hand, the orthodontist can lessen the need for rhinological work and septal operations, while, on the other hand, the rhinologist can in his own field assist the individual to a healthy and more vigorous development of the upper jaw and lessen the need for orthodontia in that region, also the general practitioner or hygienist can, by regulating the diet and training the child to eat properly, prevent dental irregularities.

It is desirable to carry to the profession at large the knowledge of the possibilities of orthodontia, knowledge that it performs far more than a cosmetic service, that while the relief of deformities has a very high value from a social and even health standpoint, these tooth irregularities contribute very largely to mouth infection and hence to organic disease. It seems true that the modern mouth is degenerate in its parts.

There may be members present who have studied this question more deeply than I have, in which case I should be more than glad to have additional evidence on this point. There is, however, abundant evidence to show that in a state of nature man's jaws are more vigorous and symmetrically developed, and that he is also comparatively free from other head abnormalities and asymmetries so common among the civilized. Whether early mental development and educational strain have anything to do with this matter, as some authorities have suggested, I am unable to say; but heredity, and deficiencies in the diet in infancy, as well as the long list of hygienic errors that characterize civilized life, must be given due weight.

These possibilities of head infection emphasize what is true of all the other regions of the body: namely, that from infancy on, they should be regularly inspected for abnormal conditions. I differ with Dr. Cabot, who claims that these inspections are of limited value unless made by specialists in each region. That is not feasible as applied to the mass of the public, but under a proper routine, as advocated by the Life Extension Institute, a well-trained general practitioner can make such periodic examinations to detect the need for further special attention.

We must sharply distinguish between the clinic for established disease and its treatment, and this sifting process by which the early signs of disease are noted and the patient shunted to whatever special clinic or clinician his needs may require.

It is amazing what an automatic, systematic sieve of this description will reveal. Indeed, it will bring out more evidences of impairment than is usually the case when a man drifts aimlessly around from one specialist's office to another. The examiner who is trained and educated to make such a survey performs the function of a sort of medical air-man, who searches out the enemy's weaknesses and gives information by which successful attack can be made.

The following figures from the examinations of the Institute will give you an idea of the operation of this principle:

RESULTS OF PHYSICAL EXAMINATIONS OF INDUSTRIAL AND COMMERCIAL WORKERS BY THE LIFE EXTENSION INSTITUTE COMPARED.

	Industrial. Average age 31.6 years.	Commercial. Average age 27.8 years.
Free from physical defects or unhealthful living habits	0.46%	0.81%
Slight impairments or errors in living habits	27.16%	22.96%
Moderate impairments, needing medical, dental, or hygienic treatment	67.15%	71.81%
Important impairments, requiring close medical supervision and treatment	5.20%	4.28%

It will interest you to know that 69 per cent of these people examined showed need of dental attention, and that among the number showing that need, organic impairment was found to the extent of 22 per cent in excess of those without dental impairment.

I think you will agree with me that this specialized assistance, such as workers in the field of orthodontia are able to render, should not be left to the haphazard initiative of patients. The detection of these abnormalities that require your aid should be a systematic, routine affair, applied to the whole population. It is then up to you to provide facilities by which the benefits of this treatment shall not be limited to the idle rich, but extended by some means to all who need it.

INTRAMAXILLARY ANCHORAGE

By Martin Dewey, D.D.S., M.D., Kansas City, Mo.

Professor of Dental Anatomy and Orthodontia, Kansas City Dental College; President of The Dewey School of Orthodontia.

INTRAMAXILLARY anchorage may be defined as that type of anchorage in which the resistance necessary to overcome a malposed tooth is obtained from a tooth located in the same arch.

Intramaxillary anchorage is divided according to two plans. The first plan is based upon the number of teeth employed in the resistance, and the second upon the manner in which the resistance is obtained. We speak of intramaxillary anchorage as being simple or compound, according to the number of teeth employed, the latter being sometimes called "reinforced." In the seventh edition of Angle's book on "Malocclusion of the Teeth," and in my work, "Practical Orthodontia," the word "simple" was used to designate anchorage according to method and is defined as being "that form of anchorage where the resistance is obtained from a large tooth more favorably located." Owing to the great amount of confusion that has arisen in the use of the term "simple," it was decided to change the term so as to refer to numbers instead of plans. Therefore, in reading this article it will be well to remember that the terms have been changed in that respect, and that "simple anchorage" is here used as referring to the number of teeth from which resistance is obtained and not to the size and location of the

anchor teeth. This may cause more or less confusion in the minds of some, but when using the term "simple" in regard to method and "compound" in regard to numbers, the confusion continually exists in the minds of students, because in the general use of these two words they are opposite in meaning.

The term "simple anchorage" is used in this paper as referring to numbers and that form of anchorage obtaining resistance from a single tooth. In Fig. 1, taken from the seventh edition of Angle's book, we have a very good illustration of a case of simple intramaxillary anchorage in which a second deciduous molar is used to overcome the resistance necessary to move the incisor. No provision has been made in the construction of the appliance to enlist

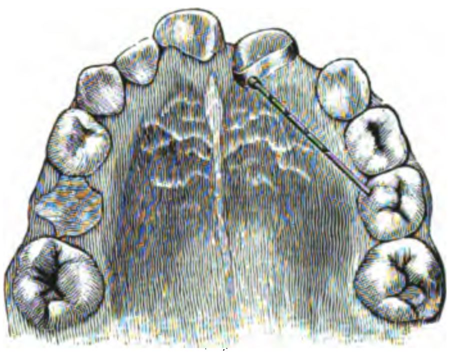

Fig. 1.

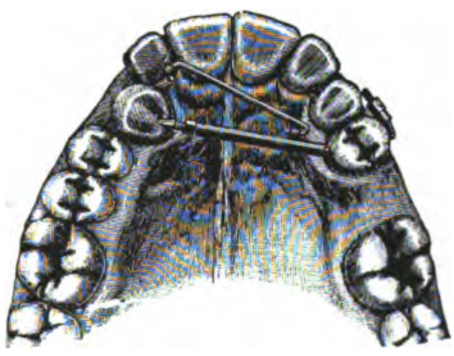

Fig. 2.

the support of any of the other teeth, however, it must be remembered that, although the appliance is attached only to one tooth, owing to the intimate connection of the fibers of the peridental membrane, there will necessarily be some force transmitted or taken up by the surrounding tissue and proximating teeth.

Compound or reinforced intramaxillary anchorage is that form of anchorage where two or more teeth are used to overcome the resistance of the malposed tooth. The construction of this appliance provides for the embracing of two or more teeth. An example of intramaxillary anchorage is shown in Fig. 2 which includes the use of the jackscrew, with attachments made to the incisor which supports the premolar carrying the anchor band; and by the proximal contact,

all of the incisors, to a certain extent, become anchor teeth. This compound or reinforced anchorage may be produced by banding more than one tooth, or it may be produced by constructing or applying an auxiliary appliance attached to a spur soldered to the band so as to embrace or rest against more teeth than would be influenced by the band itself. Fig. 3 shows a type of reinforced or compound primary intramaxillary anchorage in which a spur has been soldered to the lingual surface of the anchor band on the second premolar, the spur resting against the first premolar and molar with the result that the force exerted on

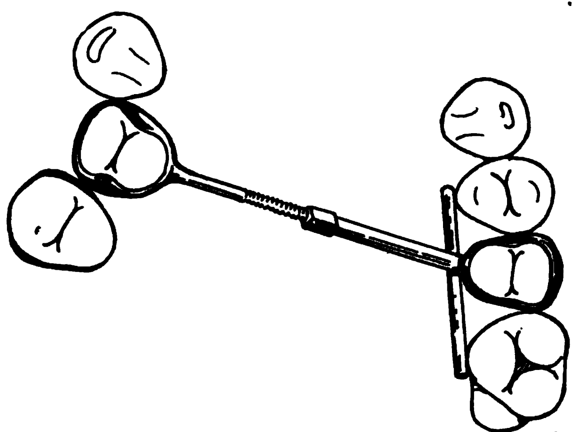

Fig. 3.

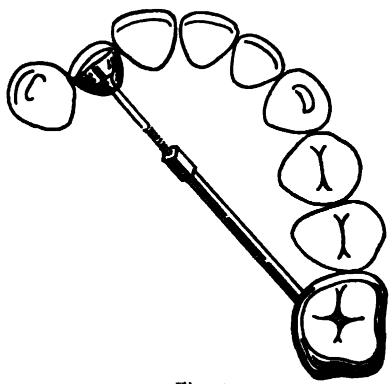

Fig. 4.

the premolar as an anchor tooth is also exerted upon the proximating molar and premolar. This presents a type of reinforced or compound intramaxillary anchorage in which the same appliance is used as shown in Fig. 4, which represents a case of simple intramaxillary anchorage. In considering simple and compound intramaxillary anchorage, it must be remembered that it makes no difference which teeth are employed, how the appliance is attached, or what kind of an appliance is used; the classification being based solely upon the number of teeth mechanically attached to the appliance. This classification, simple and compound, must not be confused with the method of attachment which brings us to another classification of anchorage. A great many more examples of simple

and compound intramaxillary anchorage might be shown, but the above are sufficient for the purpose of illustrating these two types of anchorage.

METHOD OF ANCHORAGE.

In taking up the consideration of methods of anchorage, we have to deal with the plans of obtaining the resistance to overcome the malposed teeth. We have three plans in intramaxillary anchorage which are known as primary, stationary, and reciprocal. In the classification of anchorage as given in my "Practical Orthodontia," the term used is "primary anchorage" when referring to numbers because the term "simple anchorage" has already been appropriated by other writers with reference to method. As mentioned in the first part of this paper, owing to the confusion that has arisen in the minds of students, it has been decided that it would be better for orthodontia to use the word "primary" in reference to method and let it describe the same type of anchorage as Angle has described under "simple" anchorage.

Simple primary intramaxillary anchorage is then defined as that type of anchorage in which the resistance necessary to overcome the malposed tooth is derived from a larger tooth or one more favorably located. An example of simple primary intramaxillary anchorage is shown in Fig. 4.

Compound primary intramaxillary anchorage is that form in which the force necessary to produce movement of the malposed tooth or teeth is overcome by two or more teeth larger or more favorably located. In compound primary intramaxillary anchorage, if it is necessary to move a tooth which requires a large amount of force, we obtain that force by utilizing two or more teeth and thus get the resistance from an increased number and a more favorable location. In compound primary intramaxillary anchorage, it makes no difference whether or not more than one tooth carries a band, only so far as we enlist more than one tooth as the anchor tooth. Primary anchorage has also been described as that type in which, if sufficient force is brought to bear upon the anchor tooth, it will tip through the process instead of moving bodily. The primary intramaxillary anchorage defined by Angle under the term "simple anchorage" is that "form in which, first, resistance is overcome by the anchor tooth or teeth of larger size or of a more favorable location, and second, the form of attachment to both anchor tooth, and teeth to be moved, is hinged or pivoted, admitting of tipping of both in their sockets." In this definition he includes both simple and compound intramaxillary anchorage and discusses the point that makes intramaxillary anchorage of the primary type different from stationary anchorage. Primary intramaxillary anchorage is the easiest type of anchorage obtained because, regardless of how the appliance is attached to the anchor tooth when we depend only upon the resistance of the anchor tooth, we necessarily must have primary intramaxillary anchorage. However, with this type of anchorage it must be remembered that no extra resistance is obtained by the construction or the attachment of the appliance; if sufficient force is brought to bear upon the anchor tooth it will necessarily be tipped.

With primary anchorage, the knowledge of the alveolar process and the

anatomical surroundings must be employed in order to obtain as favorable a location of the anchor tooth as possible. The relative sizes of different teeth must also be considered as well as the different degrees of ease with which the teeth move in different directions. It must be remembered that a molar can be moved mesially with greater ease than it can be moved distally. Upper molars as a rule, can be moved buccally more easily than they can be moved lingually. The reverse is true of the lower molars, especially the second and third molars. The upper incisors as a rule, will move labially more easily than they will move lingually. When speaking of the different resistance offered by different teeth when moving in different directions, it must be remembered that we are considering conditions in a normal alveolar process and with normal attachment to the teeth. One of the problems of anchorage which we encounter is the fact that in certain individuals the alveolar process is not normal as the result of which teeth move with much less force than they will in other mouths. An example of faulty alveolar process is found in those patients that have rickets or possess a rickety diathesis. In those cases, it is almost impossible to tell with any degree of certainty which teeth will move as a result of the application of force. For instance, if the alveolar process around the malposed tooth, or the one which is to be moved, is more normal than that around the anchor tooth, the anchor tooth will be displaced before the malposed tooth will move. Therefore, a set rule laid down for the movement of anchor teeth or malposed teeth as a result of anatomical resistances, can be applied only in individuals who have normal alveolar process. Owing to the fact that primary anchorage depends only upon the position of the anchor tooth and is not dependent upon the construction of the appliance so as to increase the anchorage, and owing to the fact that in a large number of cases the resistance of the tooth is not sufficient to produce tooth movement, it is necessary to evolve another type of intramaxillary anchorage which is described as "stationary anchorage."

Stationary anchorage as described by Angle is "that form in which the attachment to the anchor tooth is essentially rigid, so that tipping is impossible, and if it is moved at all, it must be dragged bodily through the alveolar process in the upright." This form of anchorage, according to Angle's writing, was first introduced in the second edition of his work, and he also refers to it in *Items of Interest,* December, 1887. He gives credit to Barrett "who first made use of this form of anchorage, though in an imperfect manner, by means of a vulcanite plate entirely covering the vault of the arch and molars, but this, of course, did not admit a strict rigidity of attachment." Stationary anchorage, however, was evolved by the early writers because of the difficulties encountered in producing certain tooth movement when depending entirely upon the "size and location of the anchor tooth." Owing to the fact that stationary anchorage differs from primary anchorage in the form of attachment, a better definition than the one given, is—stationary anchorage is that form in which the appliance is so constructed and attached to the anchor tooth that if the anchor tooth moves at all, it will be dragged bodily through the process. There are two features involved in the stationary anchorage which are not employed in primary anchorage; namely, the appliance must be constructed rigidly and must be rigidly attached to

the anchor tooth. This appliance described in Angle's work shows the use of the screw similar to the one shown in Fig. 5. Now, in order to have stationary anchorage with the traction screw, the traction screw must be so rigidly attached, and so rigidly constructed, that there will be no bending in that portion of the attachment on the canine and on the molar. It must also be so accurately adjusted that there will be no play between the tube that is soldered to the molar

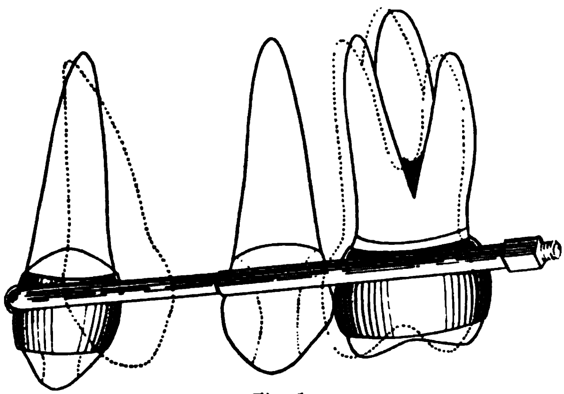

Fig. 5.

band and the portion of the screw that extends to the canines. In order to insure the rigidity in the use of the stationary anchorage, there should be as much of a point of bearing between the fixed portion of the appliance and the moving portion of the appliance as is possible. In other words, all tubes which are rigidly attached to the bands on the anchor teeth should be as long as possible to receive the portion of the appliance that is going to be the active part.

In the next installment of this paper we will take up the various methods of obtaining stationary anchorage with the alignment wire.

A "PATENT" SUGGESTION

By Harry P. Beaser, Fresno, Calif.

SINCE the time of the invention of the porcelain crown, the subject of patents has occupied the attention of the dental profession to a great extent.

From the beginning of time men have progressed by invention, which is nothing more nor less than the discovery of a new idea, and laws have been made with the object of protecting the inventor so that he can reap the benefits therefrom.

There are, however, a great number of men whose only desire is to create something new and useful, and the big majority of men in the dental profession belong, I think, to this class. But owing to the fact that there are those who are unscrupulous enough to take advantage of this generosity, these men have been compelled to protect their inventions by law when they had no wish to get any financial gain therefrom.

I would therefore suggest that the National Dental Association take the matter of patents into their hands and either create a board commission to look after this subject, or make it a part of the Research Commission. If this were done, men in all branches of the profession, and the public at large, could send their inventions to this department of the National Dental Association knowing that no individual would get the benefit of the idea for his personal gain to the exclusion of all others.

This patent board could look into the merits of the invention, and if found worthy of consideration, could obtain a patent in the name of the National Dental Association, giving the originator due credit on their records and in the *Journal of the National Dental Association.*

The dental profession, especially in America, has reached its high standard of efficiency through the inventive genius of its members; and there have been many new ideas of great value which have never gone beyond the door of the office because the founders did not wish to undergo the expense of obtaining a patent, or take the chance of losing them by giving them to the profession, and then have some one else get the patent on their article and make them pay royalty for the creation of their own minds; also for the reason that they did not wish to place themselves in the position of trying to collect a royalty from other members of the profession.

If this suggested system had been a fact a number of years ago, there is no doubt that a great deal of trouble would have been avoided; e. g., previous to the time of the discovery of the method of making the cast gold inlay, the disappearing wax models had been used for other purposes. If this had been recorded and taken care of by the National Dental Association at the time of its real discovery, no process patents would ever have been given and no trials for infringements would ever have entered the courts.

This may all be an old idea and I do not claim originality for it, but from investigations I have been able to make I have not discovered it. I believe, however, that it could be worked out to advantage even if it cost the profession a few cents per head more than their present dues, for all would reap the benefits alike and many disagreeable and costly law proceedings would be eliminated. It would certainly be a cure for a lot of unprofessionalism and trend toward bringing all men closer together for the common good.

TREATMENT OF CERTAIN TYPES OF MALOCCLUSION WITH THE AID OF BRIDGE-WORK

By H. E. Bliler, D.D.S., Chicago, Ill.

THE correction of malocclusion must necessarily be considered from different angles and there are certain factors entering into the treatment of one case which may not influence another—the time required to correct the malocclusion, the inflammation created, the inconvenience to patients, their financial status, and the best mode of procedure to obtain quick and lasting results. Every general practitioner should be able to correct simple cases, especially where it is not possible to refer the patient to a specialist, as in the smaller towns and rural districts. It is a well known fact that cases can be treated successfully at a certain age while at a more advanced period of life the treatment of them is much more

Fig. 1.—Showing models of case before and after treatment. Fifteen days was allowed for shrinkage or absorption of the V-shaped arch.

Fig. 2.—Gold crown was placed on six-year molar.

troublesome even if not prohibitive. It must also be remembered that certain people can give a considerable length of time to the treatment of malocclusion while others have a limited amount of time and cannot devote several years to the treatment, if there is any other means of accomplishing an improvement in a shorter space of time. It must also be remembered that in some instances the financial inability of the patient to pay for a long treatment, even though the result meant the ideal condition, often causes the operator to decide in favor of a plan whereby he accomplishes results in much less time even though the results are not as ideal as those that require a greater amount of time.

Fig. 1 shows the model of a case of a girl fifteen years of age who was not able to spend the necessary time and money to have the case rectified by orthodontic methods. Also the amount of deformity which is shown in the teeth would have necessitated some bridge-work in the end. Fig. 1 was made from an impression taken by having the patient bite on wax. It shows that the lateral incisors

Fig. 3*A*.—Gold crown was placed on six-year molar.

Fig. 3*B*.—Patient was a mouth-breather, not able to keep her lips closed on account of prominent centrals.

Fig. 4.

Fig. 5.

Figs. 4 and 5.—Gratifying results obtained by mechanical skill, when nature helps.

were small, consequently something was required in order to improve the lateral incisors as well as to correct the protrusion of the centrals. Both centrals, which were oversized, were extracted and the pulp was killed in the two undersized lateral teeth. February 29th I cut off the lateral teeth and made a four-tooth bridge, using porcelain interchangeable teeth, with the half-band attachment,

finishing March 3rd, giving the appearance as shown in Fig. 2. One of the central incisors was broken off, the lateral incisors were undersized, and it necessarily made a very unpleasing type of malocclusion, which is shown in Fig. 3. Fig. 4 shows the appearance of the patient's face and lips in repose after the case was treated, while Fig. 5 shows the appearance of the patient's face while smiling. In my opinion it was the correct solution of the case regardless of her ability to pay more or less.

We are aware of the fact that the extraction of an anterior tooth in the correction of malocclusion is to be avoided, but here was a case where the centrals were deformed by being oversized, one of them was broken off, the lateral incisors were small, even if the strictly orthodox plan of orthodontic treatment was followed bridge-work and restoration would have been necessary. This meant time and money as a decided factor, consequently, the method of extracting the two large incisors, and adjusting a four-tooth bridge by using the small lateral incisors as abutment, was decided upon. In fact I am very much in doubt if a better appearance could have been accomplished considering the patient we had to work on, and the condition in the beginning, if a different plan had been followed However, in the use and the construction of the bridges for the correction of malocclusion, they must be constructed according to anatomical laws, the force of the occlusion must be observed, the operator must be positive that the constructed bridge will be better in appearance than the deformed and mutilated teeth which are extracted.

I get good results many times by extracting the lower central in badly crowded conditions rather than torturing the patient by trying to widen the arch, or by extracting the first bicuspid and trying to move several teeth over. By extracting the central, the teeth will straighten themselves out, and it is good practice for poor patients, who otherwise would have crowded teeth all their lives. I extracted a lower lateral tooth for a man, 37 years old, and the teeth straightened, without any appliances, in a year's time.

BANDS OR CROWNS FOR TEMPORARY MOLARS

By W. A. Coston, D.D.S., Topeka, Kansas.

The difficulties—discomfort and sometimes pain attending the proper fitting and adjusting of anchor bands on molars, especially the temporary molars, is sometimes quite annoying to both the little patient and the dentist, and the fact that they sometimes do not stay on—that they loosen, come off, or are driven into the soft tissue by the force of occlusion, and cause inflammation of the gingivæ, if not the peridental membrane, or sometimes cause etching of the enamel, is also quite annoying. All of these things happen to the "busy dentist," and the following method, which has proved very satisfactory to the author, is suggested for the relief and the comfort of the little patient.

The indirect method of making various restorations has been a great benefaction to dentists—especially the general practitioner, and a great factor in all

prosthesis—as we have learned that crowns, inlays, clasps, and almost every appliance or restoration that is to be cemented to place, can be made with more accuracy, generally speaking, and certainly with more facility than we have been able to do by any other method. This idea applied to the making and fitting of anchor bands is quite as practical as for the making of bands or crowns for

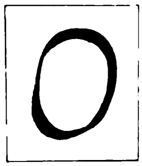

Fig. 1.—Thin copper band trimmed to festoon of gum.

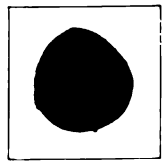

Fig. 2.—Impression of tooth in compound.

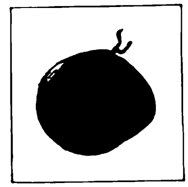

Fig. 3.—Impression with celluloid strip wrapped around it.

Fig. 4.—Impression invested in plaster.

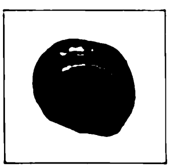

Fig. 5.—Copper amalgam model of tooth.

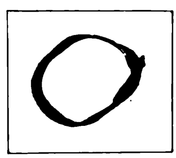

Fig. 6.—Band soldered with lap joint.

Fig. 7.—Band swedged.

Fig. 8.—Cusp swedged for band.

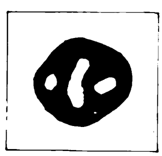

Fig. 9.—Band with cusp soldered and cut out for occlusion.

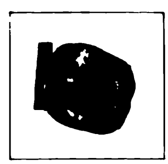

Fig. 10.—Crown with tube and lug.

any other purpose. After the necessary separation for the application of a band, an impression of the individual tooth is taken, using a thin loosely fitting copper band, trimmed to the festoon of the gum (Fig. 1), and made thin enough to pass into the approximal space without crowding, which is filled with soft modelling compound, and forced to place on the tooth. When chilled it is removed

(Fig. 2), encompassed with a celluloid strip (Fig. 3), and sunk into thin plaster (Fig. 4.) When the plaster is set the impression is filled with copper amalgam, mixed to a soft consistency as in indirect work. When the amalgam has set, the plaster containing the model is slightly warmed (for safety), broken open, and the amalgam model cleaned, using chloroform to remove any traces of modelling compound.

We now have a practical duplicate of the crown of the tooth in amalgam (Fig. 5) upon which a band of any description may be fitted with facility. In the method suggested, band material of a suitable gauge is cut from a tin foil pattern, and soldered, with lap joint (Fig. 6), and fitted to the model (joint on opposite side from the tube or other attachment), trimmed cusp-high or sometimes overlapping the cusps and marginal ridges a little. If necessary the band is slit a little and lightly burnished over and into the developmental grooves and margins to prevent displacement, and is then swedged to place in cylindrical swedge with vulcanite rubber. The band is then removed and the cusps trimmed high, allowing the band to lap over the occlusal surface at any place where it will not conflict with occlusion as in the buccal and lingual developmental groove (Fig. 7). This can now be reinforced with solder and used as a plain band, if desired, or, a thin piece of metal can be cut and annealed and swedged right over the band and model which will be forced down into the fissures and sulci and over the edge of the band (Fig. 8); then remove and solder to the band and finish. The crown, for such it is, will slip into place on the tooth, many times with a spring, and will interfere very slightly with occlusion, which interference can be remedied by grinding or cutting away the interfering metal from the occlusal surface, leaving enough overlapping the occlusal surface to prevent the band being forced gingivally into the tissue, should it loosen (Fig. 9).

The tubes or attachments can be soldered (Fig. 10), the band electroplated, and cemented to place with thin well-mixed cement, which causes it to stay on, that is, reasonably well, without any chance of gingival inflammation, if the cement is all cleaned off as it should be. The band can be any gauge desired for strength, but 34-gauge is surely thick enough. The cusp can be much thinner and in cementing the pressure should be on the band—or attachment thereto, and even a little lug can be soldered to the lingual for the purpose, as shown on Figs. 9 and 10, but pressure should not be on the soft and thin cusp.

If in the opinion of the operator the band swedged directly in the model fits too closely, first swedge and burnish tin foil, No. 60, over the model and then proceed as before mentioned—the result is accurate but loosely fitting.

A REMOVABLE RETAINING APPLIANCE

By Harry P. Beaser, D.D.S., Fresno, Calif.

RETAINING appliances are mechanical devices placed upon the teeth which have been moved from positions of malocclusion to hold them in a straight line of occluion until the natural forces have been established which will maintain them in their proper position. Retaining appliances are divided into the fixed and removable, each one of which posesses advantages and disadvantages. The fixed appliance can probably be made a little more delicate than the removable appliance, but it holds the teeth more rigidly, as a rule, and does not admit of being removed so that the teeth can receive prophylactic care during retention. In the mouths of some patients who have always kept their teeth clean and whose teeth are not susceptible to cavities, a fixed appliance may be used without any ill results. However, in those mouths where prophylactic care must be given the teeth, an appliance which is removable, so that the parts can be kept clean, is better, and will be found a great advantage.

The appliance which is shown in the cuts is a retaining appliance constructed so that it will fill nearly all of the requirements of practically any case of malocclusion. It can be made equally adaptable to a mesioclusion, neutroclusion, or a distoclusion case. The accompanying cuts show it constructed for a distoclusion case. One of the principal advantages it has over other mechanical retainers is that it is constructed as separate parts so that any one may be removed at any time without interfering with the rest. If a band becomes loosened on any tooth, it can be recemented without removing the entire appliance or running the risk of changing the shape. Each band is made and attached separately the same as an appliance constructed for treatment, thus reducing the difficulties to a minimum and at the same time producing the maximum of efficiency. It is also a well known fact that single bands are more easily set and more accurately fitted to the teeth than are three or four bands which are attached to one appliance, which necessitates the cementing of all at the same time. The appliance may be made either active or passive at any time or modified or added to at the will of the operator with the very least amount of time and trouble. Taken altogether this will come near to occupying that position so much required by orthodontists, that is, a retaining appliance which can be made into an active regulating appliance, whenever the emergency arises, and all orthodontists know this emergency arises very often. The maintenance of tooth position has caused orthodontists more trouble than all other intricacies in science. This fact is shown by early investigators who wrote at length describing all manners of appliances for the movement of the teeth with very little or nothing about retention. It is plain to admit that there was very little understood about the physiological changes which took place during the treatment of malocclusion.

It is very thoroughly understood at the present time that a correct diagnosis is absolutely necessary, not only to outline the course of treatment, but the retention as well, yet at the present time there is less difficulty experienced in

treatment, than in maintaining the teeth in the line of occlusion after they are placed there. This fact I believe is due to the construction of too rigid appliances for retention.

Nature if given a crutch will invariably lean upon it, but if forced to stand, will build a foundation for herself. This fact is proved in hundreds of

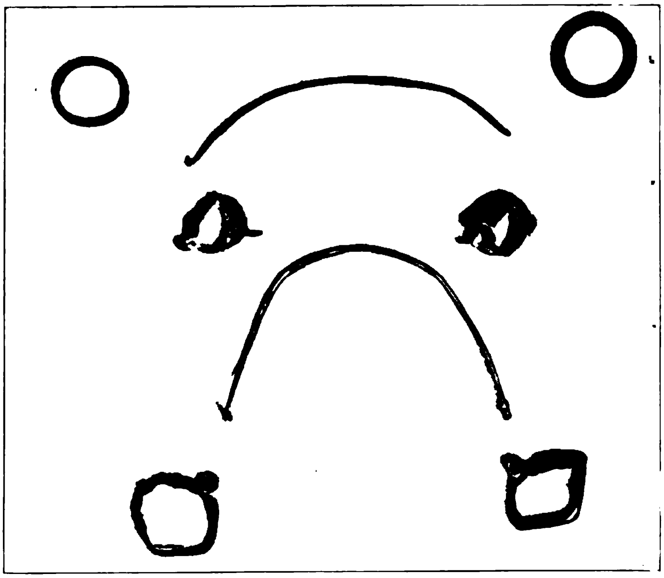

Fig. 1.

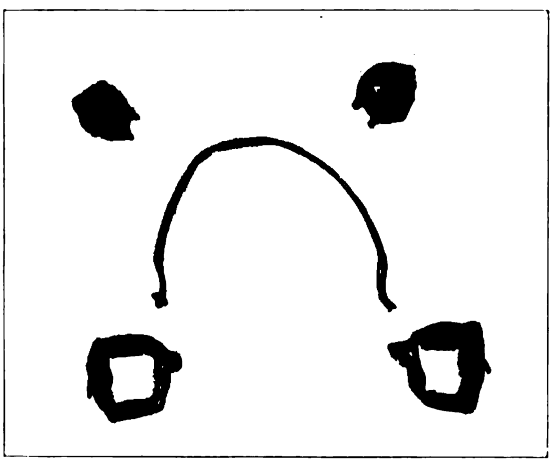

Fig. 2.

ways, for instance, the horse-riding Indians of the plains almost lost the art of walking. The body of a man who sits continuously, conforms itself to the shape of the chair, and the muscles all but lose their normal functions. A strong healthy person may start the use of drugs to stimulate some part of the system and in a short time the system requires the drug in order to perform its duty.

Thus it is with the teeth, and if a too rigid retainer is used, the teeth will lean upon it, and the tissues will atrophy instead of building strength. Therefore that appliance which will permit a free movement of a tooth in any direction, only acting as a guide to its position in the dental arch and permitting all of the forces of occlusion to act in harmony, is the one which will produce the best results.

The cuts here show the appliance fitted to a case of bilateral distoclusion which has been produced by mouth breathing. The materials used are the same as for any other appliance. Plain bands are made for the molars and canines,

Fig. 3.

Fig. 4.

upper (Fig. 1), and lower (Fig. 2). A 16 gauge vertical tube is soldered to the lingual side of the molar bands and a slot cut on the mesial surface about two-thirds of the length of the tubes from the occlusal end, large enough to permit a 20 gauge wire to slip in easily. When the wire is adjusted to the lingual surface of the teeth the ends are cut even with the inner side of the slot. The wire is then taken out and a piece of 16 gauge wire soldered perpendicular to each end making a T shape on each end of the 20 gauge wire. It is then slipped into the tubes and cut off smoothly. The T-shaped end on the 20 gauge wire which fits in the vertical tube prevents the molar from rotating.

In soldering the tubes to the molar bands they should be set at a slight angle so as to prevent the lingual wire from slipping out.

Small hooks are soldered to the linguo-cervical part of the canine bands (as in many other appliances) to engage the lingual wire and prevent it from slipping up. (Figs. 3 and 4.)

To antagonize the outward tendency of the upper anterior teeth a piece of

Fig. 5.

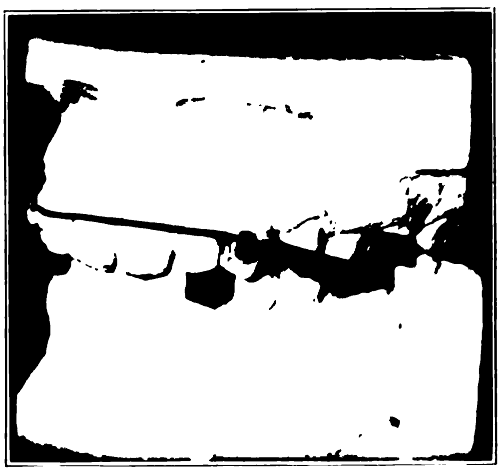

Fig. 6.

18 gauge tubing is soldered to the labial surface of the upper canine bands and a slot cut downward mesially and distally from the cervical end about two-thirds of the length, large enough to permit the easy access of a piece of 20 gauge wire. This can best be accomplished by filing the tubes about half through for the desired length and then soldering to the bands. A piece of 20 gauge wire will then be cut long enough to make a hook on each end and after being adjusted to the surfaces of the incisors will be slipped into place. (Fig. 5.) To prevent the rotation of the canine a perpendicular spur can be soldered to the labial wire to engage the tube on the canine band.

Intermaxillary rubbers will then be adjusted from the end of this labial wire to hooks on the lower molar band . (Fig. 8.) The ends of the tubes may be pinched together to prevent the wire from slipping out or being taken out by the patient, thus possessing all the qualities of the rigid soldered appliance without having any of its bad features.

If more freedom of movement is desired in the teeth to which the appliance is attached, the slots may be widened laterally at the points where the wires enter the vertical tube and the short 16 gauge pieces may be tapered at the ends giving the effect of a ball and socket joint.

Some writers have spoken disparagingly of the removable retaining appliances which various orthodontists have constructed from time to time, claiming that they were invented because of the inability of the operator to do free hand soldering with sufficient accuracy. This, however, I do not think worthy of much consideration, for a thing is not necessarily good because it is hard to make, or another bad because it is more simple; simplicity, efficiency, and durability being the most desired qualities that any appliance can possess.

Different sizes and kinds of material may be used as the operator sees fit to apply to the case in hand and modifications may be made to suit any class of work.

A REPORT OF AN ACCIDENT

By H. B. Hamilton, D.D.S., Ithaca, N. Y.

DENTAL accidents, more or less serious, are a frequent occurrence among children, and the following case is of interest because of the age of the child and the probable consequences on the growth of the mandible.

Betty H., aged eighteen months, knocked out three lower incisors in a fall down a flight of steps. The right central came out clean. The left central and lateral and a portion of the outer plate of process remained attached to the gum only, which, joining distal to lateral, was torn to the apex of the root. These two teeth lay in a horizontal position, the gum acting as a hinge and flopping back and forth with every movement of the tongue and lip.

At first, the case seemed hopeless, but it was found that the two teeth, when placed back in position, required but little to hold them. The canines were, of course, unerupted, and the age of the patient made it difficult to fit bands; so complete reliance for support was placed on the right lateral which was uninjured. A band was fitted to the lateral with a spur soldered to it sufficiently long to extend beyond the left lateral and cemented to place with the spur pressing lightly against the loosened teeth. Not quite enough pressure was obtained at first to hold the teeth back far enough, but this was corrected a few days later. Healing took place rapidly, and with the exception of recementing the piece a couple of times and removing three or four particles of process, no other treatment was required. A liquid diet was used for about four weeks. No attempt was made to replace the right central, and when last seen, about six weeks after the accident, the two teeth were in about the center of the space formerly occupied by the three teeth, and the canines just showing through the gum.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

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LOS ANGELES, CALIF.

ELECTIVE LOCALIZATION OF THE STREPTOCOCCUS FROM A CASE OF PULPITIS, DENTAL NEURITIS AND MYOSITIS*

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LOCALIZED infections in or about the roots of teeth have already been considered in causal relationship to systemic disease and to neuralgia of the face. Experimental proof of the nature of this relationship, however, is still undetermined. In this paper I wish to record the history of a case in point and the results of experiments which appear to throw light on the subject.

Case 567.—Mrs. F. H. P., aged thirty-five years, had been subject to severe migraine for many years. For the past five or six years she has suffered from recurring attacks of neuralgia of the face, which began with severe pain and distinct swelling over the left upper jaw, spreading to the opposite side, with soreness in the teeth, especially in the upper jaw, and followed by intense pain in the left side of the head, neck and shoulders. During the last two or three years the attacks have occurred oftener and had grown so severe as to necessitate the frequent use of hypodermics of morphine; the attacks have ended with spasm of the muscles, and tenderness and swelling of the neck on the left side. Her tonsils were removed four years ago, but this did not relieve the condition. One year ago the second left upper molar showing a blind abscess at the root was extracted, the left maxillary sinus drained and a piece of the left turbinate removed, but without relief. She became extremely nervous, at times hysterical during the paroxysmal pain, and has had one or two spells of mental confusion suggesting *petit mal.* Previous to tonsillectomy, she had had for years one or more attacks of tonsillitis followed by rheumatic pains during the winter months.

Examination revealed a poor vasomotor tone, moderately firm muscles, fair nutrition, and the general appearance of a nervous woman. On January 13, the hemoglobin was 85 per cent; the leukocytes 9800. A Wassermann test of the blood proved negative. On February 17, the hemoglobin was 80 per cent; the erythrocytes 4,210,000; the leucocytes 5400. There were no signs of organic disease of the central nervous system. The examination of the

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heart, lungs, abdomen, reflexes, urine, Rœntgen examination of the jaws, roots of teeth, and blood pressure, were all negative. There was tenderness over the left infraorbital foramen and mental foramen, but no superficial tenderness of the overlying skin. There were tender nodules, which appeared to be enlarged glands in the posterior triangle of the left side of the neck. There was a clean tonsillectomy scar, a normal condition of the nose except moderate hypertrophic rhinitis, and a normal condition of the gums and teeth, except a tender dead first upper left molar which had been crowned, but from which the crown had been removed on account of the irritation of the gums. The maxillary sinuses were clear. Owing to the fact that each attack began with swelling of the left upper jaw opposite the dead tooth and in the region of the left infraorbital foramen, the tooth was extracted January 18. There was found a semi-lunar eroded area 2 mm. in diameter near the apex of the largest and inner fang. The surface of this was sterilized with a searing blade, and the root-canal drilled into from the apex with a dental burr. The pulp-cavity was filled with a foul-smelling pus. The erosion was situated so that it was impossible to be shown by the Rœntgen ray. The pulp-cavity of the other two fangs was filled and obliterated and there were no erosions at the apices. There was a large cement filling directly opposite the dead pulp. Smears from the pus from the root showed a few Gram positive diplococci, diphtheroid bacilli and a few Gram negative bacilli. The primary cultures in ascites-dextrose agar and broth gave a pure culture of a slightly hemolyzing streptococcus. The anerobic cultures on blood agar slants and in tall columns of ascites fluid containing sterile tissue, covered with paraffin oil, had a foul odor and many short chains of streptococci and numerous bacilli resembling *Bacillus fusiformis*.

Immediately after the extraction of the tooth, the patient developed an unusually severe attack but she gradually recovered after several exacerbations. On February 17, after having been free from pain for ten days and gaining rapidly in weight and strength, there was found a definite tenderness of the muscles in the posterior triangle on the left side of the neck and two distinct tender nodules just behind the posterior margin of the sternomastoid muscle. One of these tender nodules, thought to be a lymph-gland, and a portion of the deeper layers of the muscle, was excised. One-half of these tissues were immediately emulsified for cultures and the other half fixed in formalin-Zenker for sections. The excision of the fascia and muscle precipitated another violent attack of pain and spasm of the muscles of the left side of the neck. The cultures in tall columns of ascites plain broth of the emulsion of muscles showed a pure culture of a short chained streptococcus and those from the thickened fascia, streptococci and staphylococci.

Blood agar plates from the culture in ascites plain broth from the tooth pulp and from the muscle (injected into animals) showed pure cultures of streptococci producing a narrow hazy zone of hemolysis. It was thought that this streptococcus might be present quite generally on the mucous membrane in this patient. Cultures from the nose and pharynx and three out of six cultures from the stool proved that this was actually the case.

Sections of the excised muscle showed marked increase in the interstitial

tissue, poorly staining nuclei of adjacent muscle fibers, and slight round cell infiltration (Fig. 1). Sections of the fibrous nodule and fascia showed old and young connective tissue, absence of lymphoid tissue, small nests of round cells, plasma cells, and erythrocytes, chiefly around blood vessels. Gram-Weigert and methylene blue stains for bacteria revealed a moderate number of diplococci in or adjacent to the fibrous tissue between the muscle fibers and nests of cel-

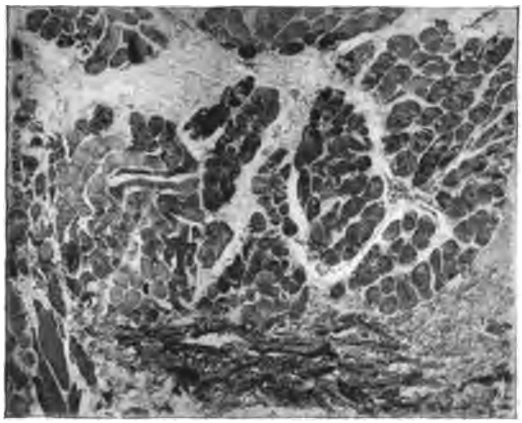

Fig. 1.—Section of the muscle excised from the left side of the patient's neck. Note the marked infiltration by connective tissue, the irregular staining and the atrophy of muscle fibers. Hematoxylin and eosin. X 60.

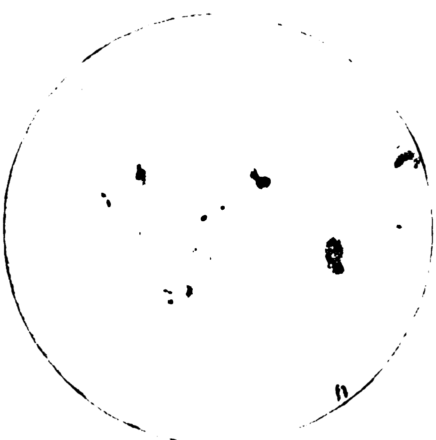

Fig. 2.—Diplococci, singly and in short chains, and two leucocytes in tender fibrous node in the deep fascia from the left side of the neck. Methylene blue and eosin. X 1000.

Fig. 3.—Diplococci within the lumen and in the wall of the blood vessel and within the leucocyte just outside of the blood vessel in the center of the tender fibrous nodule of the deep fascia from the left side of the neck. Gram-Weigert. X 1000.

lular infiltration (Fig. 2) and a large number within and surrounding a small sized blood vessel in the center of the fibrous nodule (Fig. 3).

A vaccine was prepared by heating the streptococci suspended in salt solution from the primary cultures of the pulp of the tooth and muscle and treating it with equal parts of the patient's serum for two hours at 37°F and over night

in the ice chest. This was used in the treatment of the patient. The first dose consisted of 25,000,000, and was followed by marked muscle pains, especially at the left side of the neck, by nausea, extreme exhaustion and slight fever. The subsequent injections were at first diminished and then gradually increased, aiming to give a distinct but not severe reaction following the injection. Dr. Grimes, who referred the patient to me, reported three months after the extraction of the tooth, that the patient has shown gradual improvement; the attacks are milder and of shorter duration, the intervals between attacks are longer, and there has been marked improvement in the general nervous tone.

ANIMAL EXPERIMENTS.

Intravenous injections were made into rabbits, guinea-pigs and dogs, and intraperitoneal injections into mice. The streptococcus as isolated from the pulp of the tooth was injected into 4 rabbits, 2 guinea-pigs and 2 white mice, all of which recovered. The primary culture after one animal passage was injected into 2 rabbits, 1 dog and 2 mice. The rabbits and dog recovered; the mice died. Thirteen animals were injected. In 10 of these circumscribed hemorrhages and edema opposite the roots of teeth or at the foramina of exit of the superior or inferior maxillary nerves were easily visible; in 7 there were lesions of the muscles, 4 of which were limited largely to the muscles of the left side of the neck; in 6 there were lesions of the pulp of the teeth and the superior or inferior dental nerves; and in 3 there were insignificant lesions of the kidney, 2 in the gall bladder and 1 in the stomach. The spleen, adrenal, endocardium, vagus and sympathetic ganglia and subcutaneous nerves were normal. No lesions were found in the nerves supplying hemorrhagic muscles. The diphtheroid bacillus did not produce lesions in the one rabbit and one mouse injected.

The streptococcus from the muscle in the first and second cultures was injected into 2 rabbits, 1 guinea-pig and 1 mouse, producing lesions of the muscles, chiefly of the neck and shoulders, in all. In the rabbits there were also hemorrhage and infiltration of the dental nerves, and gross lesions in the dental pulps and periosteum opposite the roots of the teeth. In 1 there were a few hemorrhages of the stomach, in the other, hemorrhages of the kidney; in the mice there was a mild peritonitis.

To the portion of the above cultures of streptococci left over and having marked affinity for the muscles, was added 0.5 per cent formalin. This was allowed to stand over night at room temperature, a portion put aside for direct injection; the rest was centrifuged and the bacteria washed in Ringer's solution. The former was injected intravenously into a rabbit in amounts of 10 c.c. on four occasions over a period of eleven days. The rabbit showed a moderate number of small hemorrhages in the muscles of the hips and shoulders and a few in the stomach. The washed suspension was injected one month later into 3 rabbits, each receiving the growth from 150 c.c. of the broth cultures. All died in twenty-four hours. The muscles in all had a boiled appearance, and those about the shoulders, neck and spine had large and small hemorrhages associated with edema; 2 had, in addition, a hemorrhage of the pulp of the teeth; and 1 a few hemorrhages about the joints, in the tricuspid valve and in the left inferior dental nerve. The lungs were free from hemorrhages.

Two cubic centimeters or approximately 500,000,000 of the heat-killed streptococci failed to produce lesions, but this may have been due to the small size of the dose. The filtrate of the formalinized cultures failed to produce lesions in the muscles following 3 injections of 10 c.c. each into 1 rabbit. Three injections into 1 rabbit over a period of eleven days of the slightly hemolyzing streptococcus from the pharynx were followed by moderate numbers of lesions in the muscles in the right side of the neck, the right elbow and right shoulder and in the intercostal muscles. The streptococcus from the stools in the second cul-

Fig. 4.—Rabbit (R 656) showing marked lacrimation of the left eye and swelling of the left side of the face forty-eight hours after the intravenous injection of streptococcus from the pulp of the extracted first upper left molar.

ture did not produce lesions. The living streptococci from the tooth, muscle, pharynx and stool in the first or second cultures, and after one animal passage, and the heat or formalin-killed streptococci, were injected altogether into 24 animals (15 rabbits, 3 guinea pigs, 1 dog and 5 mice). Of these 17 (71 per cent) showed myositis, 13 (54 per cent) lesions of the periosteum opposite teeth or at nerve foramina 12 (50 per cent) lesions of the pulp of teeth and 10 (42 per cent) lesions of the dental nerves.[2] Similar results have been obtained since

[2]The incidence of the lesions in the other organs corresponded with those given in my paper on "Elective localization of streptococci," Jour. Am. Med. Assn., 1915, 45, 1687-1691.

in 2 cases of myositis and arthritis with streptococci isolated from the diseased pulp of extracted teeth.

Previous to these experiments lesions of the pulp of teeth and the dental nerves were not usually looked for, but recently careful search for similar lesions in these structures has been made in numerous animals injected with streptococci from other sources. In three instances only were there found lesions of the pulp of teeth and dental nerves. Two of these animals showed myositis in addition. The details in the following experiments will serve to illustrate specifically the results obtained:

R 656.—Belgian hare, 1510 grams weight. January 19, 1916, injected intravenously with the growth from 30 c.c. of ascites-dextrose-broth of a pure culture of streptococcus from the pulp of the extracted tooth.

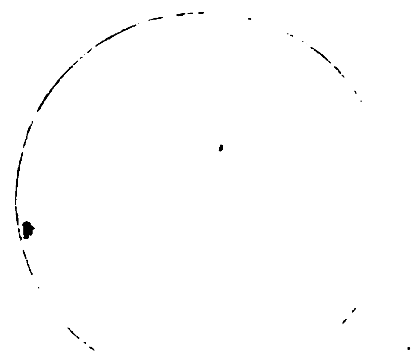

Fig. 5.—Diplococcus in an area of hemorrhage in the left superior dental nerve of rabbit shown in Fig. 4. Gram-Weigert. X 1000.

January 20. Seemed quite ill; respirations were accelerated; appeared to have pain in walking and promptly crouched when quiet. The hair was roughened and there was marked lacrimation of the left eye, but no swelling of the face.

January 21. Seemed much better; was more active but tremulous, and appeared nervous. There was lacrimation of the left eye and an easily recognizable swelling of the left side of the face (Fig. 4). Slight pressure over this area appeared to cause pain and the swelling could be easily felt. Chloroformed. A rather large number of linear hemorrhages in the skeletal muscles, chiefly in the tendinous portions of the flat muscles of the shoulder and deeper muscles of the left side of the neck and of the front extremities were found. There were no lesions of the muscles of the hind extremities, the dorsal and lumbar regions of the spine, nor of the intercostal muscles and diaphragm. On removing the skin on the left side of the face, marked edema, infiltration and hemorrhage of the subcutaneous tissue, the fascia, the muscles and the periosteum, were found The hemorrhages in the periosteum opposite the molars appeared to be the center of the edêmatous area. The hemorrhagic infiltration extended to the under surface of the orbit. The pulp of the left third and fourth upper molars was found to be edematous and hemorrhagic. The hemorrhages were small and punctate and were not found in the pulp of the 2 corresponding teeth on the

opposite side. On dissecting away the soft tissues of the lower jaw, it was found that hemorrhages of the periosteum had occurred opposite the apices of the right lower incisor, and the first and two last molars, the second left lower molar, and surrounding the right mental foramen similarly to the lesions shown in Fig. 6. The pulp of the teeth surrounded by hemorrhages in the periosteum was found to be edematous and hemorrhagic, whereas 3 adjacent pulps appeared

Fig. 6.—Left lower jaw of rabbit (R 659) injected three days previously with 5 c.c. of twenty-four hour tissue-ascites-fluid culture of the streptococcus from the tooth. Note the edema and hemorrhage in the periosteum opposite the root of the canine and surrounding the inferior dental nerve at the foramen of exit. X 2.

Fig. 7.—The pulp of the inferior canine and inferior dental nerve from dog (D 412) two days after an intravenous injection of the streptococcus isolated from the hemorrhagic pulp of the second upper left molar. Note the numerous large and small hemorrhages in the pulp of the left lower pulp and nerve. X 2.

normal. The left superior dental nerve was extremely hyperemic and a number of small hemorrhages were found in the sheath. The only lesions of the viscera were 3 small hemorrhages in the mucous membrane of the pyloric end of the stomach and 3 small subserous hemorrhages at the fundus of the gallbladder.

January 23. Blood-agar plate cultures of the blood produced 1 colony of streptococcus; of the emulsions of the pulp of teeth 5 and 18 colonies respectively. Cultures in ascites-dextrose broth from the emulsions of the pulp of 2 teeth, of

the hemorrhagic muscle, of the edematous tissue over the jaw and of the hemorrhagic periosteum, showed a short chained streptococcus.

Sections of the edematous tissue over the left jaw showed extreme hemorrhage, edema and beginning leucocytic infiltration. In the pulp of 2 teeth from which sections were made, were large and small hemorrhages chiefly beneath the layer of odontoblasts, and in the left superior dental nerve were small areas of hemorrhage in the sheath. Sections of hemorrhagic areas in the scapular muscles showed marked hemorrhage between the muscle fibers, separation and fragmentation of the latter, and slight leukocytic infiltration. Gram-Weigert stains showed diplococci in or adjacent to the hemorrhagic areas in the edematous periosteum, in the muscle from the scapula, in the pulp of the teeth, and in the left superior dental nerve (Fig. 5).

D 412.—A white and black dog, weight 9:5 kilos. January 22, injected intravenously with the growth from 90 c.c. of ascites-dextrose broth of the streptococcus from the hemorrhagic pulp of a tooth of the above rabbit.

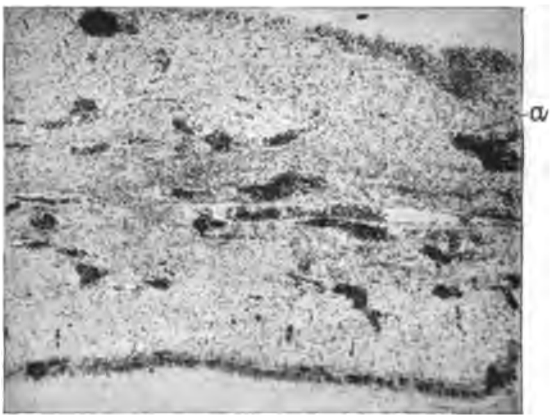

Fig. 8.—Section of the pulp of the left lower canine shown in Fig. 7. Note the marked hyperemia and the large and small hemorrhages. Hematoxylin and eosin. X 60.

January 24. Seemed well; was active; no swelling of the face; no tenderness over joints nor muscles. Chloroformed. The left inferior dental nerve was found to be edematous and hyperemic and contained a number of large and small punctate hemorrhages (Fig. 7). The pulp of the corresponding canine tooth likewise appeared edematous and contained numerous punctate hemorrhages. The corresponding nerve and pulp on the opposite side appeared normal (Fig. 7). There were similar but less marked lesions of the left superior dental nerve and pulp of the canine tooth. The first upper and lower molars were examined and only the first left lower molar showed unmistakable hemorrhage. The muscles were free from visible lesions except for a few hemorrhages in the flat muscles under the scapulæ. In a painstaking examination of all the organs no other apparent lesions were revealed.

January 25. Blood-agar slants made from the blood were sterile.

Sections for microscopic study were made from the left inferior dental nerve, from the pulp of the teeth mentioned, and from the superior maxillary

nerve. Hemorrhages and beginning leucocytic infiltration were found in the pulp of the left inferior canine (Fig. 8) and a small number of hemorrhages in the pulp of the first left lower molar, but practically none in the others. These hemorrhages were most numerous immediately beneath the layer of odontoblasts and at the distal portion of the pulp (Fig. 8). Sections of the left inferior dental nerve showed marked edema, a moderate leucocytic infiltration and a number of large and small hemorrhages chiefly in the sheath (Fig. 10). There

Fig. 9.—Diplococci, singly and in short chains, within and outside leucocytes, adjacent to the area of hemorrhage shown at *a* in Fig. 8.

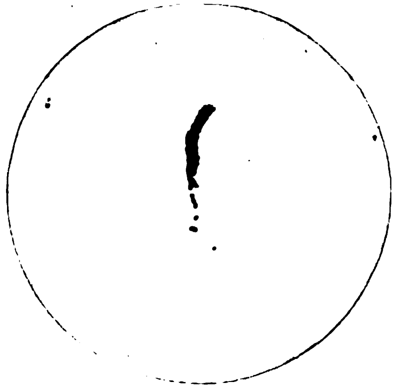

Fig. 11.—Diplococci and double chain of streptococci in the hemorrhagic and infiltrated area (*a*) in the sheath, shown in Fig. 10.

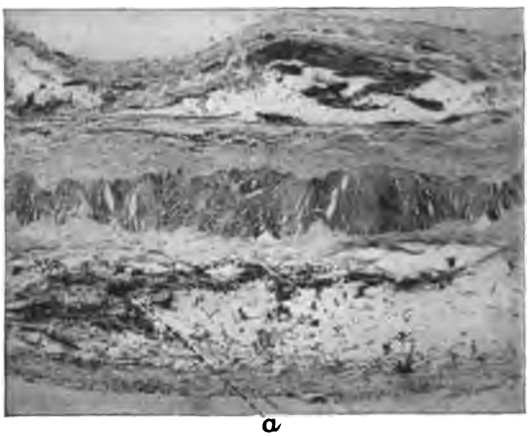

Fig. 10.—Section through the hemorrhagic area in the left inferior dental nerve, shown in Fig. 7. Note the marked edema and large and small hemorrhages and leucocytic infiltration of the sheath. Hematoxylin and eosin. X 60.

were no lesions in the left superior maxillary nerve. Gram-Weigert and methylene blue stains for bacteria showed scattered diplococci and at times chains of diplococci in and adjoining the hemorrhagic areas (Figs. 9 and 11). In one instance, a mass of diplococci surrounded by erythrocytes was found just outside the wall, and 2 diplococci in the wall of a small blood vessel. In a number of instances the diplococci were found within leucocytes and in what appeared to be endothelial cells. No bacteria could be found in the normal portions of the pulps and nerves showing lesions, nor in those free from lesions.

P 155.—White guinea-pig, weight 320 grams. February 19, injected intravenously with the growth from 30 c.c. of ascites-dextrose broth of the streptococcus isolated from the muscle of the patient.

February 21. Seemed quite well, but appeared to be muscle-sore. Chloroformed. Numerous small hemorrhages associated with edema in the triceps muscles and a moderate number in the muscles of the left shoulder and a few hemorrhages in the deeper layer of the muscles of the left side of the neck

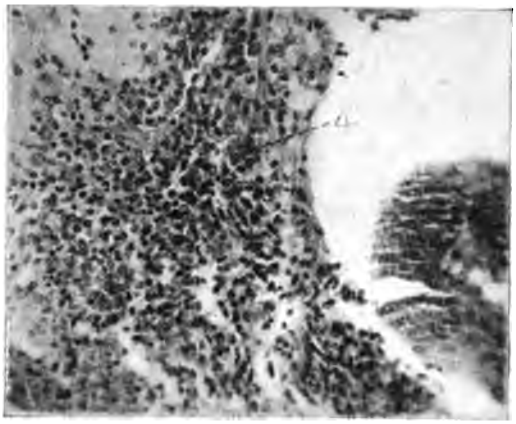

Fig. 12.—Section of the dental pulp of the left upper molar in guinea pig (P 141) injected two days previously with the streptococcus from the pulp of the patient's tooth. Note the marked leucocytic infiltration and hemorrhage. Hematoxylin and eosin. X 240.

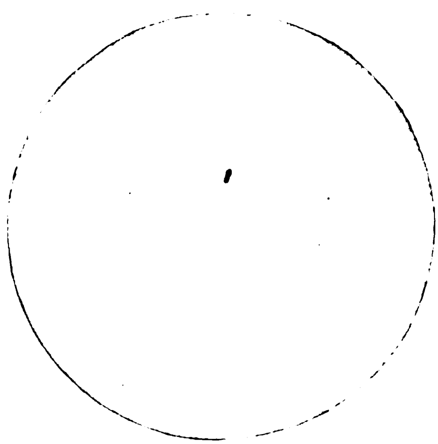

Fig. 13.—Diplococcus in infiltrated area (*a*) shown in Fig. 12. Gram-Weigert. X 1000.

were found. There were no lesions of the dental nerves but the pulp of the two left upper molars was extremely hyperemic and contained distinct hemorrhages. There were no other findable lesions.

February 24.—Cultures from the blood in ascites-dextrose broth were sterile.

Sections through the areas of hemorrhage in the scapular muscle showed marked extravasation of blood corpuscles, leucocytic infiltration, separation and necrosis of muscle fibers (see Fig. 14 illustrating similar lesion in triceps muscle).

Sections of the pulp of the left first upper molar showed a number of small hemorrhages while in those of the superior maxillary and right superior dental nerve there were no lesions. Gram-Weigert and methylene blue and eosin stains showed a few scattered diplococci in the hemorrhagic and infiltrated area in the muscle and adjacent to the hemorrhages in the tooth-pulp (Fig. 15).

Fig. 14.—Section of the left triceps of guinea pig (P 155) injected two days previously with the streptococcus from the muscle of the patient. Note the marked hemorrhagic and leucocytic infiltration and separation of muscle fibers. Methylene blue and eosin. X 140.

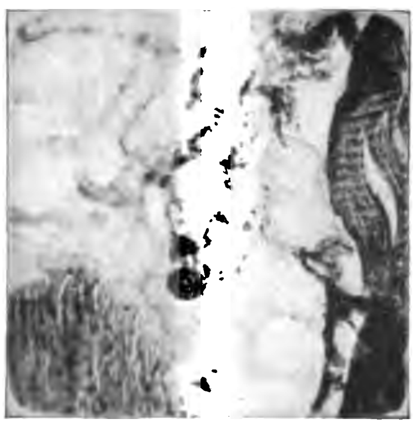

Fig. 15.—Diplococcus in infiltrated area shown in Fig. 14. Gram-Weigert. X 1000.

THE STREPTOCOCCUS.

The streptococcus isolated from the dead pulp of the tooth, the muscle, the pharynx, and the stool, produced small, round, slightly elevated grayish-brown, non-adherent, rather dry, colonies on aerobic blood (human) agar plates. In broth it produced a diffuse turbidity with a small amount of flocculent sediment at the end of forty-eight hours. It acidified and coagulated milk. In liquid media it grew in short chains and diplococci. In many instances, the single members of the diplococci were quite round and resembled staphylococci. The strains from the tooth and muscle were freely susceptible to phagocytosis

and the virulence was of a low order. The streptococci from blood agar slants in salt solution used as a vaccine resisted 60°C. for thirty minutes on consecutive days, while after the third heating the subcultures remained sterile. The blood of the animals soon became sterile, and nearly all recovered promptly from the effects of injection. The organism resembled very closely the streptococci that

Fig. 16.—Section of the left trapezius in rabbit (R 660) forty-eight hours after intravenous injection of the streptococcus from pulp of the left upper molar in rabbit shown in Fig. 4. Note the marked edema, leucocytic infiltration, hemorrhages and the disintegration of the muscle fibers. Hematoxylin and eosin. X 120.

I have isolated from other cases of myositis and strains from other sources having affinity for muscles.

In Table 1 is given the fermentative power of the strains isolated from the pulp of the tooth, the muscle, the pharynx, and the stool. It is seen here, as has been found to be the case with other streptococci, that there is little parallelism between pathogenicity and the degree or range of fermentative powers.

TABLE 1

FERMENTATIVE POWERS OF THE STREPTOCOCCUS*

Streptococcus	Dextrose	Lactose	Saccharose	Maltose	Raffinose	Mannite	Salicin	Inulin
Tooth pulp	2.4	1.5	0.9	1.9	0	1.3	2.0	0
Pharynx	1.9	1.8	0	1.6	1.8	1.0	0	0
Muscle	1.5	1.2	1.5	1.3	0	0	0	0
Stool	2.9	2.3	1.1	3.2	0	0	2.3	0

*The standard sugar-free broth containing the usual amounts of the various carbohydrates was used in the fermentative tests. The cultures were incubated 72 hours. The figures indicate the number of cubic centimeters of normal tenth sodium hydrate required to neutralize 5 c.c. of the broth culture, phenolphthalein being used as an indicator.

SUMMARY.

A streptococcus having peculiar properties was isolated from the dead pulp of the left upper first molar in the region where the attacks of pain usually began. The streptococcus was also demonstrated in the sections and isolated from the

infiltrated deep fascia and muscles of the left side of the neck. A similar streptococcus was isolated from the pharynx and stool. This streptococcus was proved to have elective affinity for the pulp of teeth, dental nerves and muscles in animals. It was repeatedly isolated from and demonstrated in the experimental lesions in animals whose blood was sterile; the lesions were again produced on reinjection and the streptococcus again isolated. Many animals appeared to be in pain and 1 rabbit (Fig. 4) had marked swelling and tenderness over the left upper jaw. This affinity was proved absent in the diphtheroid bacillus and *Bacillus fusiformis,* which also were isolated from the pulp of the tooth, and in the streptococcus broth culture filtrate. Streptococci from other sources rarely cause lesions in the pulp of teeth and dental nerves. The phagocytic power of the patient's blood following the attack over the strain from the tooth was twice that of comparable normal blood.

These results would appear to warrant drawing the conclusion that the attacks of pain in the face in this patient were due to a streptococcus infection of the sheaths of the dental nerves, and that the pain, swelling, tenderness and spasm of the muscles of the neck were due to myositis and fibrositis—the result of infection by this streptococcus. The demonstration of living streptococci in the pulp of the tooth and in the fascia and muscle during quiescent intervals is significant and may explain the recurrence of the attacks. The cavity in the tooth containing the dead pulp, which was originally infected from the mouth, judging by the character of the filling and of the bacterial flora, was quite unable to heal for mechanical reasons. The contents of the cavity appeared to afford a culture medium for the growth of the streptococcus. From stimulation of the defensive mechanism in the patient during the attacks, active growth appeared to be held in check and the symptoms disappeared in consequence, only to reappear later from recurrence of active growth and localization of the streptococci when the immunity was low.

The improvement in the patient since extraction of the tooth appears to be due to the removal of this focus and to prolonged artificial stimulation of the defensive mechanism by means of the autogenous vaccine, which, it is hoped, will lead to the destruction of all the streptococci in the muscle and dental nerves, and result in the ultimate recovery of the patient. However, the isolation of this streptococcus from so many places, indicates that complete recovery will probably be difficult.

PLEA FOR A MORE GENERAL USE OF THE X-RAY

By Dr. Harold B. Thompson, Seattle, Wash.

THE value of x-ray in the diagnosis of dental pathology has been appreciated by a few men in both the dental and medical profession for a number of years. More recently the increase of x-ray equipment, together with considerable literature on the subject, both in professional and lay periodicals, has wonderfully broadened the field and increased the application of this modern diagnostic aid.

There are still a large number of men in both the dental and medical fraternities who do not avail themselves of this help in diagnosis, at least to a sufficient extent for their own welfare. Whether this neglect is due to ignorance, habit, or an axaggerated opinion of one's own diagnostic ability, it is certainly inexcusable. There still remain a few physicians who will volunteer to treat fractures without the aid of the x-ray, even when radiographs are available; but through slow education, the use of the x-ray has become so universal, that the failure to procure an x-ray examination in fractures, when possible, now constitutes a prima facie cause for an action of malpractice. It is only a question of time, if the time has not already arrived, when the failure of the dentist or physician to avail himself of the aid of the x-ray in dental conditions, will render him liable for malpractice to the same extent. The use of the x-ray then, constitutes a form of insurance against malpractice suits, and the premium is paid by the patient.

The work of Dr. Rosenow along the line of bacterial origin of arthritis, ulceration, appendicitis, gall bladder diseases, etc., is familiar to all in the profession. So much has appeared in the lay literature recently along this line, that the public is beginning to demand an x-ray examination of the teeth, sometimes even before the physicians or dentists. Although all my work is referred work, I have recently had several cases appear for dental radiographs without being referred, when the symptoms were confined to general joint conditions or to the abdominal organs. It is certainly more to the credit of the attending man to anticipate a patient's wishes in this regard than to have the course of action suggested by the patient.

It is often a desire for economy on the part of the attendant when he does not ask or insist on a radiograph. Numerous experiences have shown me the fallacy of this line of procedure. One dissatisfied patient can do more harm than several pleased ones can do good. A patient who has been treated for several weeks or even months by one man and then changes to another, who refers the case for a radiograph and with its aid completes a cure in a short time. has good reason to become a "knocker." A patient's health is his most valued possession, and he will appreciate your interest in his case as shown by your desire for all the information possible, even though the radiograph gives no material aid.

I have intentionally omitted in the body of this article, an enumeration

Fig. 1-*A*.

Fig. 1-*B*.

Fig. 1.—Typical apical abscesses.

Fig. 2.—Absorption of tip of root and decalcification of surrounding alveolar process.

Fig. 3.—Small area of rarefaction (apical abscess) at tip of lateral incisor.

Fig. 4.—Small areas of rarefaction at tips of right middle and lateral incisors.

Fig. 5.—Small fragment of alveolar process left after extraction of tooth and causing persistent sinus.

of the specific class of cases in which the x-ray has proved of inestimable value, as this has been ably covered time and again in recent literature. My plea is more for a general line of attack, than a plea for the use of the x-ray in any specific class of cases, and you will find this general attitude of availing yourself of all possible aids in diagnosis to rebound to your benefit.

Fig. 6.—Decalcification of alveolar process surrounding root of crowned pivotal tooth from pyorrhea.

Fig. 7.—Decalcification at surface of alveolar process, extending downward at side of canine and appearing also at tips of middle and lateral incisors, pyorrhea.

Fig. 8.—Unerupted canine.

Fig. 9.—Impacted third molar causing "neuralgia."

Fig. 10.—Unerupted canine causing "neuralgia" by pressure against the root of the lateral incisor.

Fig. 11.—Incomplete filling of root canal.

A recent case which came under my observation, shows the value of another laboratory test, but the application is the same. A specialist sent a case to the hospital one day and engaged the operating room for the following morning, intending to do an extraction of all the teeth for an aggravated case of pyorrhea. The young interne at the hospital noticed the peculiar pallor of the patient and

Fig. 12.—Showing acute curve in root, giving excuse for drilling through side of tooth.

Fig. 13.—Hole drilled through side of tooth with filling protruding, causing necrosis of alveolar process.

Fig. 14.—The dentist has drilled through the side of the root and then inserted a root canal filling which has caused necrosis of the bone. In attempting to remove this filling a small pair of forceps has been broken off outside the tooth.

Fig. 15.—Protrusion of root canal filling, causing necrosis.

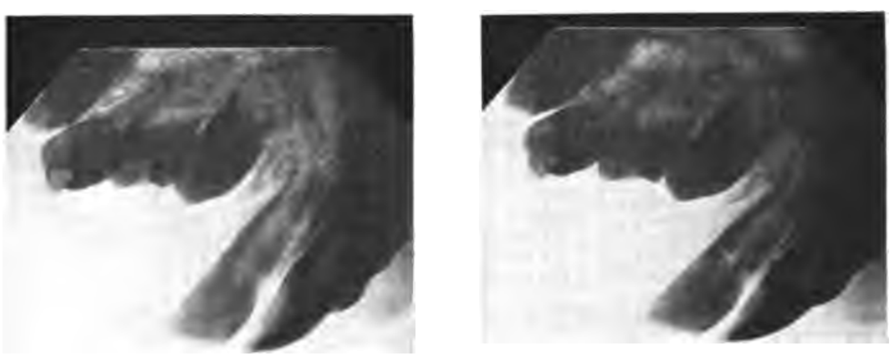

Fig. 16-*A*. Fig. 16-*B*.

Fig. 16.—Stereoscopic radiographs showing the direction of growth of unerupted teeth.

took a blood smear, which showed an advanced typical case of leukemia. Needless to say the operation was postponed, and well it was, for the patient died within a week, and his death would probably have been attributed to the operation, had it been done.

The accompanying illustrations will serve to call to mind some of the more obvious specific cases in which great benefit may be expected from the use of the x-ray.

My plea for a more general use of all possible aids in diagnosis, particularly that of the x-ray, as it has a much greater field in dental work than any other laboratory method, may be summarized as follows:

1. A more general use of the x-ray will allow a more positive diagnosis with consequent more particularized treatment, and better and quicker results.

2. The more general use of the x-ray is a form of insurance against malpractice suits with the premium paid by the patient.

3. The risk of having your patient become a "knocker" is transferred to the man who fails to use the x-ray.

4. The appreciation of your thoroughness when the patient is convinced that you are using every means at your disposal to alleviate his condition, will prevent dissatisfaction in many cases and engender a confidence which even unfortunate results will not be able to overcome.

News and Notes

Dr. E. Santley Butler, practice devoted exclusively to orthodontia, has announced removal of offices from Room 704 to Suite 605, 576 Fifth Avenue, New York City.

* * * * *

Drs. Sturdevant and Dinham, practice limited to orthodontia, announce their location at 919-920 Selling Building, Portland, Oregon.

* * * * *

Dr. Blaine Truesdell announced the removal of his offices to Suite 1112 First National Bank Building, Omaha, Nebraska. Practice limited to orthodontia.

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EDITORIALS

The Universal Regulating Appliance

REGULATING appliances are mechanical devices for exerting force on the malposed tooth for the purpose of creating cell activities thereby causing the tooth to assume its proper position in the line of occlusion. A universal regulating appliance is one that is capable of being used to the best advantage upon all cases. The ideal regulating appliance must possess certain requirements, the first of which is efficiency. It must be capable of doing the things which it is intended to do. It must exert force upon the malposed tooth with the result that cell activity will occur and the tooth be moved into the line of occlusion. After efficiency, there are other things to be taken into consideration with reference to making an ideal appliance. One of the requirements of any appliance is that of stability and anchorage, by which we mean the appliance must be so attached as to be capable of exerting the desired force. It must also be so attached that it will exert force in the proper direction so as to produce the proper cell activity and tooth movement.

In going through orthodontic literature we find that there are several appliances which seem to approach the ideal. There are several styles of appliances upon the market which, in the hands of certain men, will easily accomplish the desired result. These appliances may be divided into two groups, known as "fixed" and "removable," each one of which has certain advantages and disadvantages. When we consider the radical mechanical difference between those two appliances it seems almost an impossibility to talk about any one appliance which will fulfill the requirements possessed by both the "fixed" and "removable." It has been stated by Dr. Eby that the regulating appliance of the future will be one that will embody the advantages of both the fixed and removable, combining them into an appliance which might be termed the "fixed removable" type. In studying the results of orthodontic treatments of times past, we might say that so far as mechanism and the construction of an appliance in regard to tooth movement is concerned, we have appliances which are ideal. We have several styles of appliances which seem to be able to correct any case of malocclusion encountered. In other words, if the movement of the malposed tooth was the only thing to be considered we would be able to select several styles and kinds of appliances, any of which would produce that movement. However, the movement of the malposed tooth is not the only thing to be desired as has been revealed to the sorrow of some men. In considering an ideal regulating appliance, we have to consider the material from which the appliance is constructed. When we take up the question of material we are immediately confronted with one of the biggest problems we have to contend with from the standpoint of ideal conditions. Up to the present time we have no metals or materials which may be considered ideal. A metal which possesses one requirement to a very high degree of efficiency will be decidedly lacking in another. For instance, several years ago the majority of regulating appliances on the market were made out of German silver. German silver possesses a great many ideal characteristics, the principal one of which is the ease with which it may be worked and also its antiseptic properties. Looking over the large number of cases which have been treated with German silver appliances in the past, we find some very nice results have been obtained; we also find some of evil effects. We find that in a great many instances some of the anchor teeth were discolored, were turned black from a black stain or oxide very difficult to remove. In checking up these results, however, we are forced to admit the actual amount of decay which occurred in the mouths of those treated with German silver appliances was comparatively slight. However, as a result of the tarnishing of the German silver and as a result of its appearance, it was not satisfactory from an esthetic standpoint. Therefore, a large number of men began using gold and platinum and iridio-platinum, because the appliances were more pleasing in appearance. In other words, they sacrificed the antiseptic properties in the metal for the esthetic, with the result that an examination of the cases treated by gold and platinum and iridio-platinum appliances show a very great loss of tooth structure. In other words, the amount of decay which has occurred with the use of the iridio-platinum and gold and platinum appliances is far in excess of that which occurred in the use of the German silver appliance. To eliminate this decay which resulted from gold and platinum appliances, some men began advocating the banding of every tooth that the

appliance would touch, advocating a layer of cement to protect the teeth. The use of so many bands on the teeth to prevent them from decaying defeated the purpose of the better appearance of the noble metals as compared to German silver, for nothing is more unsightly than a large number of bands on anterior teeth.

In using bands there is always the ultimate danger of the bands resting against the tissue, and we now have oral prophylactic specialists who condemn orthodontic treatment because of the injuries to the gingival tissues produced by bands. The facts remain that if one band occasionally injures the gingival tissue, that injury is more apt to occur where a large number of bands are used than if very few bands were used. Even in the construction of the removable appliance which does not employ any bands, we have to take particular care to avoid injury of the gingival tissue with the gingival extension which is made to go under the lingual convexity to hold the appliance; but there is very little liability to decay providing the appliance is carefully cleaned and taken care of as it should be. However, there is one disadvantage in the removable appliance,—the placing of the appliances on the lingual side may interfere with the speech of the patient. Therefore in this respect the removable appliance is not ideal.

We have mentioned that appliances were changed from German silver, to gold and platinum, and iridio-platinum for the esthetic effect, which brings out the point that the esthetic effect or appearance of the appliance is an important thing to be considered. A great many patients do not care how efficient the appliance is from a mechanical standpoint, if it looks well, and they prefer a less efficient appliance to one that is conspicuous. Therefore we have to consider the question of appearance in regard to regulating appliances, and the ideal appliance must be so constructed as to be inconspicuous if not entirely out of sight. In regard to inconspicuousness, the majority of removable appliances have an advantage over a large number of fixed appliances.

Another requirement of the ideal appliance, about which many statements have been made is that it must produce physiological cell activities. Just what the activities of cells are as a result of the regulating appliance is not exactly understood. We do not know, however, that the results of some of these appliances have not been satisfactory from the standpoint of cell activity. We have known of several cases where the roots of the teeth have absorbed for some reason or other during tooth movement. We do not know exactly why this was, except as a general statement, that the proper cell activity was not produced. The question remains, "What is the proper cell activity to be expected from regulating appliances?" The answer to this question can only be given in a general statement: namely, that the cell activities produced by the regulating appliance should be in keeping with the same cell activity that occurs as a result of normal development. In other words, malposed teeth moved by regulating appliances should follow as nearly as possible the movement produced by a tooth during the process of eruption. To approach this style of tooth movement, the appliance must be so constructed that the teeth will be free to respond to the forces of mastication and not lashed or bound rigidly by any fixed or firm appliance. Also during the eruption of the majority of teeth they do not travel in a straight line, they do not travel bodily in one direction, but tip more or less during their movement. If you will examine the position of the upper teeth

before eruption, as they lay in their crypts, it will be seen that they must travel buccally a considerable distance and a large amount of that traveling is the result of tipping. The lower molars and premolars as a rule travel lingually to a certain extent which also is the result of tipping. This lingual movement of the lower molars is especially true in the deciduous teeth, although the permanent teeth do not travel lingually as much as the deciduous teeth. Any appliance then that exerts pressure to produce physiological cell activity will be one that will not interfere with the individual development or growth of any one tooth, neither will there be undue pressure brought to bear on the teeth in any one particular direction.

We have outlined a number of the requirements of the ideal appliance, and in a general way, stated some of the difficulties which are encountered. With the large variety of malocclusions which we are called upon to treat at the present time it seems that the best plan is not to look for a universal regulating appliance, but choose the appliance which more nearly approaches the ideal in that particular case. An appliance which may be desirable in one individual or case of malocclusion would not be so ideal in another case. Therefore, we believe at the present time, that the greatest service will be rendered the patient if the orthodontist will become able to analyze regulating appliances from a mechanical standpoint, and consider what is required in the treatment of the particular case in hand and select the appliance from the standard types which have been proved worthy and useful. We do not believe that it is necessary to make and design a separate appliance, based on new mechanical principles for every case of malocclusion which we treat. Any regulating appliance regardless of whether it is a fixed or removable variety exerts pressure upon the teeth in only two ways, either pushing and pulling, or by a combination of the two, which is twisting. After an appliance is secured which does that, there only remains the selecting of an appliance with some means of properly attaching it to the malposed tooth to obtain the desired force to produce the mechanical stimulation which will cause the cells to respond in a physiological manner. We also believe it is a mistake to say any one style of appliance, because it has been advocated by a group of men, is the only kind to use. We must realize that in certain instances other appliances might better serve the need of the case, be more comfortable to the patient, and be less conspicuous and more hygienic. There are even instances when a simple appliance will do the work as satisfactorily as a more complicated one.

Therefore, the question of the regulating appliance of the future remains for the individual operator to be able to analyze his case so as to be able to select the best appliance for the particular case; and possibly, far in the future, we may evolve an ideal regulating appliance.

Is Our Dental Literature Free from Commercial Influence?

THERE is one question which arises in the comparison of the literature of the dental profession with that of the medical profession and other scientific bodies. That question is whether our dental literature is controlled or influenced by commercial houses, or whether commercial influence is exerted upon the

publication of our articles; for the majority of our dental journals, those which have the largest circulation and which may be said to be representatives of dental literature, are journals controlled by trade houses. It is a lamentable fact that the dental profession, at the present time, has but few journals that are not influenced by trade houses or under the control of houses interested in selling dental goods.

We are aware of the fact that the medical profession passed through a similar stage several years ago, before the *Journal of the American Medical Association* reached its present standing. This resulted in the improvement of medical journals controlled by publishing houses, and the elimination of trade journals. We now have high class scientific journals which have no commercial appliances for sale and which also are free from, or not interested in, the selling of medical supplies.

We have often wondered whether the dental journal that is controlled and published by a house whose sole object is the selling of dental supplies is published in the interest of the profession, or whether it is not published for the advertising of their own products. We are aware of the fact that editors of the dental journals have very high ideals, and, so far as the ideals of the editors, or the editors themselves, are concerned, we have no criticism. However, it has been brought to our attention that several of the editors of dental journals are heavy stock-holders in the supply houses that publish journals. We, therefore, wonder if those particular editors could serve the interests of the profession as well as if they were not interested in the selling of dental supplies. We wonder if they would publish in their journals papers written by scientific men criticizing very severely some of the articles in the sale of which the supply house is interested, and which are advertised very extensively in the advertising department of the journal. It might be that our dental editors would wish to do so, but we very seriously doubt that the supply house or the publishers of the journal would allow such a thing to occur. It has been shown that there are several very extensively advertised cements on the market which, by scientific analysis, do not carry out the claims made by their manufacturers. We, therefore, wonder if the publishers would allow a criticism of such cements from a purely scientific standpoint to appear in their journal at the same time their advertising pages would be highly lauding the advantages and wonderous properties which they possess. We believe that the dental editor would be more able to serve the interest of the profession from a scientific standpoint if his sole business was the editing of the journal, and if he was not interested in the sale of dental articles.

In some journals, articles are published as scientific which are really only advertisements for some material or appliance. Papers are also often written for the purpose of selling articles which are advertised in the pages of the journal. We remember recently a very prominent dental trade journal which contained a featured paper on the first pages describing a new appliance. This particular appliance may have a great many virtues, but it is often plain to see that some papers are written to sell appliances. A great many claims are made for that purpose. In the same issue of that trade journal there appeared a featured advertisement calling attention to the wonderous qualities of an appli-

ance and referring back to a paper published as a scientific paper. Since that time the supply house has sent out advertisements broadcast in which they include reprints of the paper, which are mailed along with the catalogue of the appliance. The advertisements of the appliance are constantly referring to the paper which was published in the journal. Would the same prominence be given to a paper which presented scientific criticism of the aforesaid appliance? Would they publish a criticism of an article which they widely advertised? We believe that commercialization of scientific papers from a professional standpoint is very poor policy. If papers were written showing the weakness of widely advertised articles, would the publishers be as willing, for the scientific advancement of orthodontia, to give a paper criticizing some of their appliances the same publicity they would give the paper calling attention to the virtues of the appliance We believe that the virtues of any article should be published broadcast, but we also believe that it should be published in a scientific manner and not in a commercialized manner.

If dentistry is a science, it must have journals that are willing to publish scientific papers even if the papers criticise materials and appliances that are products of the publisher. It has been called to our attention that there are some trade journals that will not illustrate any style of an appliance unless manufactured by their own house. This again is a commercialization of scientific literature which handicaps the profession, and which the dental profession should remember, contributes to the weakness of their literature as compared with that of the medical profession.

The Small Gauge Regulating Appliance

SEVERAL years ago the majority of appliances or alignment wires placed upon the market were made of 16 gauge material. The 16 gauge arch was the universal regulating appliance which at that time was made principally of German silver or some other alloy. When it became the common plan of treatment to correct malocclusion of the deciduous teeth, the 16 gauge arch was found to be too large. There then was a tendency towards the use of 18 gauge arches and at that time the 18 gauge was the smallest arch placed upon the market. Since that time arches have been manufactured in all gauges varying from 16 to 20 and some even as small as 36 thousandths of an inch. As a result of the use of the small gauge arch, some men have been inclined to discard the large gauge in favor of the small, claiming the small gauge is less annoying to the patient and consequently should be used in all cases. We are willing to agree that the small gauge arch up to 19 or 20, or even 25 or 36 thousandths of an inch, may have advantages in some cases; but, it by no means replaces the large arch, in some cases, if the most efficient regulating appliance is desired. The small gauge arch has its limitations as well as its usefulness and it should by no means be considered the ideal appliance for all conditions.

The small gauge arch can be used satisfactorily in those cases of malocclusion which require a reciprocal anchorage, in those cases of neutroclusion where all the teeth have to be expanded an equal amount; it is ideal because of

its delicate spring which works for a considerable length of time without readjusting. We find in other types of malocclusion that it possesses several disadvantages. One disadvantage of the small gauge arch is that it must be fitted very close to the teeth, for owing to its small diameter, it is much more liable to injure the cheek than an arch of a larger size. If the patient lies on the side of his face during the night the small gauge arch is more liable to cut into the cheek than a 16 gauge arch. Owing to the small gauge arch possessing a large amount of spring it is contraindicated in those cases where the point of attachment is far removed from the anchorage. In other words, if the small gauge is used on cases where it is necessary to move the four anterior teeth forward without any expansion in the molars or premolars, it possesses disadvantages because of the tendency to spring buccally between the attachment on the incisors and the molar anchorage. The same trouble would recur if the small gauge arch of 25 or 36 thousandths of an inch was being used to open up the space for a premolar by carrying the anterior teeth forward by the action of the nut. If we were going to have stationary anchorage on one side and primary anchorage on the other, or if our case was one that required expansion in the molar region on one side and the holding of the molar stationary on the other, it would be difficult to secure stationary anchorage with the small gauge arch owing to the elasticity which would permit the arch to spring. Likewise, in the use of the intermaxillary anchorage where we desire the backward movement of the teeth, as in the treatment of a mesioclusion case, there is a great tendency for a small gauge arch to spring between the molar anchorage and the attachment of the intermaxillary rubber. These are only a few of the conditions where a small gauge arch is contraindicated, but for the benefit of a large number of men, especially the younger men, who may become over enthusiastic over the use of the small gauge arch, we are mentioning these disadvantages. Dr. Lourie has stated that the shorter the regulating appliance between the points of attachment, the smaller the gauge can be. In other words, there is a limit to the smallness of the gauge of the alignment wire where it is lingual or labial, and this limit depends upon the nature of the teeth movement to be accomplished, the direction from which the force is to come from the appliance, whether it is to be entirely a spring force or a pushing force derived from the action of the nuts, whether the attachments to the appliance are close together, and whether reciprocal anchorage or stationary anchorage is to be used.

The advantages and disadvantages of the small gauge arch should be studied from a scientific standpoint, and it will be found useful in one case and a hindrance in another.

Dr. William Goode

DR. WILLIAM A. GOODE, Orthodontist, San Diego, California, was drowned in the Cuyamaca Lake, Sunday, November 19th, when his light duck boat was capsized by a strong wind. Dr. Goode with a number of San Diego physicians and dentists had gone to the lake Saturday night for an outing over Sunday. Dr. Kerch and Dr. Goode were in a light duck boat which

was capsized by a large wave about two hundred yards from shore. After clinging to the boat a short time, Dr. Goode, who was very athletic, started to swim to shore. He had gone about half way when he disappeared, probably as a result of the chilly water and also being weighed down with heavy hunting clothes and ammunition. Dr. Kerch was rescued by hunters in another boat, and they attempted to reach Dr. Goode when he sank.

Dr. Goode was thirty-four years of age, having lived in San Diego twenty-two years. He was a graduate of the Sherman Heights School, the San Diego High School, and Pomona. While a student at Pomona, he was a member of the Pomona football team. He graduated from the Northwestern University Dental School in 1910, and took a postgraduate course in the Dewey School of Orthodontia.

Dr. Goode leaves a widow, who, before her marriage, was Miss Ethel Speaker, physical director of the San Diego High School.

Dr. Goode had a very brilliant future, he was very well esteemed by both the medical and dental professions. While he had only shortly taken up the practice of orthodontia, from the success he obtained in other lines, we are sure that orthodontia loses a good man by the untimely death of Dr. Goode.

A New Fourth Edition of Prinz "Dental Materia Medica and Therapeutics"

THE dental profession is now happily informed of Dr. Hermann Prinz's new (4th) Edition* of "Dental Materia Medica and Therapeutics," and is hereby potentially offered a new cause of congratulating itself upon the numerous enrichments presented in the new volume. While our dental literature may be apparently well supplied with text-books treating the subject either as a separate branch or in connection with dental operative procedure which might well answer the demands of the student and practitioner, yet a new volume is always welcome if it exhibits some special features or "strong points" not already elaborated in similar works. The many new and special features in Prinz's new book meet our eyes by first impression upon casually glancing through its pages, and upon closer analysis, we find the new volume is as fairly concise as it is fully comprehensive. The author's indefatigable efforts to establish dental therapeutics on modern pharmacological research within the fullest limits of present possibilities must finally win our admiration for his strong advocacy for rationalism as against empiricism. We may define materia medica and place as a synonym with it the term "pharmacology" if we hold to this distinction that the latter name, in addition, implies the *specific action* of the drugs upon the various tissues, organs, and functions of the body. In this sense, Dr. Prinz has given us more than a materia medica, he has presented us with a dental pharmacology of inestimable value.

*Dental Materia Medica and Therapeutics. By Hermann Prinz, D.D.S., A.M., M.D., Professor of Materia Medica and Therapeutics, The Thomas W. Evans Museum and Dental Institute School of Dentistry University of Pennsylvania, Philadelphia; formerly Professor of Materia Medica and Therapeutics and Director of the Research Laboratory of the Dental Department of Washington University, St. Louis. 640 pages, 146 illustrations, fourth edition. Price, $5.00. Published by The C. V. Mosby Company, St. Louis.

This pharmacology constitutes the bulk of his volume and is contained under the heading "Pharmaco-Therapeutics," a term very appropriately coined for the author's intention and accomplishment. That the author himself, lays much claim to this part of his book, appears from the prefaces of his first and subsequent editions.

Dr. Prinz's classification of drugs according to their specific action is a logical sequence of the basal consideration for which we employ drugs at all; namely, their action. For a materia medica purely, it is quite immaterial what classification is adopted, but in the pharmacologic sense, where the action of the drugs is primarily concerned, it is but natural that this action should also constitute the basis of their classification. We can scarcely conclude our remarks on this classification without commending the natural and agreeable order in which the author has arranged the various classes. For instance, the antiseptics, covering nearly one hundred pages are given first consideration because they are absolutely of prime importance to the dentist. These antiseptics are immediately followed up by the astringents and the caustics on the principle that the action of these three classes of agents is one chiefly of degree depending on the concentration. The author then introduces successively the chapters on the hemostatics, the demulcents and emollients, the irritants and counterirritants, etc.

While Prinz's "Pharmaco-Therapeutics" constitutes the essence and substance of his volume, yet, this part is not introduced until the author has acquainted us with Part I which he entitles "General Therapeutics" and in which he seizes the opportunity of laying a solid foundation for the better understanding of the succeeding subjects. This part contains the author's introduction which displays his ability as a writer and affords sufficient interest to merit its reading a number of times on account of the historical data contained in it. The chapters on the "Aims of Therapeutics," "Classification of Dental Remedy," "Methods of Administering Medicines," "Prescription Writing," etc., are well and ably written with a view of imparting thorough and reliable information.

These two parts thus briefly reviewed would constitute the subject matter of a materia medica proper, but Dr. Prinz's book being, besides, a treatise on dental therapeutics must, necessarily, also consider those remedial agents which do not participate in the characteristic of material substances. These agents are considered under the heading of "Physical-Therapeutics" which forms Part III of the volume and covers some fifty pages. The leading subjects of this part are those on "Artificial Hyperemia," "Massage," "Light Therapy," "Heat and Cold," and a few others. Those subjects are all treated in their most recent conception and acceptation. The author also introduces under this heading of Physical-Therapeutics, the new and very interesting subject on "Ionic Medication." Unfortunately, in the opinion of the reviewer, this subject should not have been included under the general heading of Physical-Therapeutics, because its treatment at this point creates the impression as though ionic medication is essentially a pharmacological one, the employment of the electric current being only a means of transporting the *material* ions into the tissues of the body. The treat-

ment of the subject, therefore, belongs rather to Pharmaco-Therapeutics than to Physical-Therapeutics.

The author has reserved for a separate part (Part IV) of his volume the very important subject of "Local Anesthesia" to which he devotes not less than seventy pages. This part is a complete and thorough exposition of every detail of local anesthesia, both in principle and in technic. Conductive anesthesia, so much talked about in recent times, is also fully considered at this point and we might add here, that this phase of anesthesia has appeared in all former editions of Prinz's, so that it is not a new subject in this book. Dr. Prinz's treatment of local anesthesia may be rightly considered as one of his strong points.

In the new edition, many of the subjects have been completely rewritten while a large number of others have received extensive alterations and additions of new matter, among which we note the following articles: "Constituents of Organic Drugs," "National Narcotic Laws," "Biologic Test for Arsenic," "Formalin Dermatitis," "Formaldehyd as a Desensitizing Agent," "Emetin in the Treatment of Pyorrhea Alveolaris," "Quinin and Urea Hydrochlorid," "Ionic Medication," and "Radio-active Substances."

We cannot conclude our review without taking due notice of the manner in which Dr. Prinz supplements his writings with fitting illustrations. The number of illustrations accompanying the text is one hundred and forty-nine. A crude figure on the black board of a triangle assists the mathematician in his intricate and extended calculations, although the dimensions of the lines are purely imaginary and do not enter into his speculations. So it is with a fitting illustration in a text; it guides the imaginative faculty which directs the mental thought. Personally the reviewer attaches great value to these illustrations, a characteristic feature of Prinz's book. The reviewer is reminded of a Dental Congress from which one seldom departs without taking with him some fresh resolutions which were engendered right in the exhibition hall. Last, and not least, we laud the publishers for the mechanical execution of the new volume which is perfect in every respect.